ALLIANCE FOR AUTOMOTIVE INNOVATION

Alliance for Automotive Innovation

Comments to the National Highway Traffic Safety Administration

Regarding

Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks

Docket ID No. NHTSA-2021-0053

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1050 K Street, NW
Suite 650
Washington, DC 20001

AutosInnovate.org

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List of Abbreviations

The following abbreviations are used in these comments.

2010 Rule	Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25324, 25326 (May 7, 2010)
2012 Rule	2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule, 77 Fed. Reg. 62624 (Oct. 15, 2012)
2020 SAFE Rule	The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks; Final Rule, 85 Fed. Reg. 24174 (Apr. 30, 2020)
2021 NAS Report	*Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2025-2035*, National Academies of Sciences, Engineering, and Medicine, Washington, DC: The National Academies Press (2021)
ACC2	California's Advanced Clean Cars 2 rulemaking
(The) Agencies	Collectively the National Highway Traffic Safety Administration and the U.S. Environmental Protection Agency
AECD	Auxiliary emission control device
AMFA	Alternative Motor Fuels Act of 1988
APA	Administrative Procedures Act
Auto Innovators	Alliance for Automotive Innovation
Auto Innovators GHG Comments	*Comments on EPA GHG Proposed Rule for MYs 2023-2026*, Alliance for Automotive Innovation (Sep. 27, 2021), Docket ID NHTSA-2021-0053-0021
BatPac	Argonne National Laboratory Battery Performance and Cost model
BEV(s)	Battery electric vehicle(s)
CARB	California Air Resources Board
CAFE	Corporate Average Fuel Economy
CAFE Model	The CAFE Compliance and Effects Modeling System

CAFE NPRM	Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks, 86 Fed. Reg. 49602 (Sep. 3, 2021)
CAFE TSD	*Technical Support Document: Proposed Rulemaking for Model Years 2024-2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards*, National Highway Traffic Safety Administration (Aug. 2021)
CARB	California Air Resources Board
CO_2	Carbon dioxide (generally used interchangeably with greenhouse gas for the purposes of this comment)
CO_2e	Fuel economy carbon dioxide equivalent
DLE	Direct lithium extraction
DOT	U.S. Department of Transportation (used interchangeably with National Highway Traffic Safety Administration)
DRC	Democratic Republic of Congo
EIA	Energy Information Administration
EISA	Energy Independence and Security Act of 2007
EPA	Environmental Protection Agency
EPA RIA	*Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards; Regulatory Impact Analysis*, U.S. Environmental Protection Agency, EPA-420-R-21-018 (Aug. 2021)
EPA Trends Report	*The 2020 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, U.S. Environmental Protection Agency (Jan. 2021)
EPCA	Energy Policy and Conservation Act of 1975
ESG	Environmental, social, and governance
EV(s)	Electric vehicle(s) including battery electric, plug-in hybrid electric, and fuel cell electric vehicles
EV Multipliers	Advanced technology incentive multipliers; *see* 40 C.F.R. 86.1866-12
FCEV(s)	Fuel cell electric vehicle(s)
FCIV	Fuel consumption improvement value

FE	Fuel economy
FMVSS	Federal Motor Vehicle Safety Standards
FP	Footprint
g	Grams
gpm	Grams per mile
GHG	Greenhouse gas
GHG NPRM	Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43726 (Aug. 10, 2021)
GVWR	Gross vehicle weight rating
HDV(s)	Heavy-duty vehicle(s)
ICE	Internal combustion engine
IGF	Intergovernmental Forum on Mining, Minerals, Metals, and Sustainable Development
LDV(s)	Light Duty Vehicle(s)
LFP	Lithium-iron-phosphate
MDPCS	Minimum domestic passenger car standard
MIT	Massachusetts Institute of Technology
MPG	Miles per gallon
MPGe	Miles per gallon equivalent (for electric vehicles)
MPV	Multipurpose passenger vehicle
MY(s)	Model year(s)
NAS	National Academies of Sciences, Engineering, and Medicine
NCA	Lithium-nickel-cobalt-aluminum oxide
NMC	Lithium-nickel-manganese-cobalt oxide
NHTSA	National Highway Traffic Safety Administration

NHTSA RIA	*Preliminary Regulatory Impact Analysis: Proposed Rulemaking for Model Years 2024-2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards*, National Highway Traffic Safety Administration (Aug. 2021)
ODI	National Highway Traffic Safety Administration Office of Defects Investigation
OPEC	Organization of the Petroleum Exporting Countries
PEV	Plug-in electric vehicles (includes BEVs and PHEVs)
PHEV(s)	Plug-in hybrid electric vehicle(s)
RIA(s)	EPA and NHTSA Regulatory Impact Analyses
SAB	EPA Science Advisory Board
SCC	Social cost of carbon
SLR	Static loaded radius
TSD	Technical Support Document
UK	United Kingdom
U.S. or US	United States of America
VSL	Value of a statistical life
ZEV	Zero Emission Vehicle, includes electric vehicles
ZEV Mandate	Zero Emission Vehicle Mandate as implemented by the California Air Resources Board

Introduction

The Alliance for Automotive Innovation ("Auto Innovators")[1] hereby submits comment on the U.S. Department of Transportation ("DOT") National Highway Traffic Safety Administration ("NHTSA") proposal to revise Corporate Average Fuel Economy ("CAFE") standards for model years ("MYs") 2024-2026 light-duty vehicles (the "CAFE NPRM").[2]

We have evaluated the NHTSA proposal in the context of ongoing, parallel actions being taken by the U.S. Environmental Protection Agency ("EPA") to revise their light-duty vehicle greenhouse gas ("GHG") regulations (the "GHG NPRM")[3] and by the State of California to develop their Advanced Clean Cars 2 ("ACC2") proposal.[4]

We value your careful consideration of our comments. Auto Innovators represents automakers that produce nearly 99 percent of the new light-duty vehicles sold in the United States, Tier 1 suppliers, and technology and mobility companies. The auto industry remains an essential and important part of the U.S. economy and manufacturing sector, supporting more than 10 million jobs, and is responsible for 5.5 percent of our nation's gross domestic product.

Summary of Comments

Support for the Biden Administration's Goals and the Need for Complementary Actions

Auto Innovators and its members support a goal of achieving 40-50% U.S. new light vehicle market share of electric vehicles ("EVs") by 2030, including battery electric vehicles ("BEVs"), plug-in hybrid electric vehicles ("PHEVs") and fuel cell electric vehicles ("FCEVs"). On August 5, 2021, President Biden signed Executive Order 14037, "Strengthening American

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[1] The Alliance for Automotive Innovation is the singular, authoritative and respected voice of the automotive industry. Focused on creating a safe and transformative path for sustainable industry growth, the Alliance for Automotive Innovation represents the manufacturers producing nearly 99 percent of cars and light trucks sold in the U.S. The organization is directly involved in regulatory and policy matters impacting the light-duty vehicle market across the country. Members include motor vehicle manufacturers, original equipment suppliers, as well as technology and other automotive-related companies. The Alliance for Automotive Innovation is headquartered in Washington, DC, with offices in Detroit, MI and Sacramento, CA. For more information, visit our website http://www.autosinnovate.org.

[2] Corporate Average Fuel Economy Standards for Model Years 2024-2026 Passenger Cars and Light Trucks, 86 Fed. Reg. 49602 (Sep. 3, 2021), hereinafter "CAFE NPRM."

[3] Revised 2023 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions Standards, 86 Fed. Reg. 43726 (Aug. 10, 2021), hereinafter "GHG NPRM."

[4] *Advanced Clean Cars II Meetings & Workshops*, California Air Resources Board, https://ww2.arb.ca.gov/our-work/programs/advanced-clean-cars-program/advanced-clean-cars-ii-meetings-workshops (accessed Sep. 14, 2021).

Leadership in Clean Cars and Trucks," which includes a goal for 50 percent of all new passenger cars and light trucks sold in 2030 to be EVs (including battery electric, plug-in hybrid electric, and fuel cell electric vehicles). The same day, multiple automobile manufacturers announced a shared aspiration to achieve sales of 40-50% of annual U.S. volumes of EVs by 2030 to move the nation closer to a zero-emissions future consistent with Paris climate goals.[5] Other automobile manufacturers made similar commitments leading up to and following the signing of Executive Order 14037. Collectively, automakers have committed to investing more than $330 billion to transforming cars and trucks to an exciting, electrified future,[6] and are on pace to debut almost 100 BEV models by the end of 2024.[7] Additional details are available in Appendix I, "Our Vision for the Future."

The Need for Complementary Actions

Action is needed today to implement ten specific complementary measures to grow EV sales through MY 2026 and to significantly expand those sales beyond MY 2026. NHTSA itself projects that EV sales need to minimally grow to 13 percent of the U.S. market by MY 2026,[8] a fivefold increase from last year's sales at 2.5 percent.[9] Needed actions include: (1) developing electric and hydrogen refueling infrastructure; (2) expanding consumer purchase incentives to reduce near-term costs; (3) enacting laws and regulations that require private and commercial fleets to adopt EV technology; (4) developing and supporting domestic supply chains for battery and EV component manufacturing; (5) adopting a nationwide low carbon fuel standard; (6) developing a battery and EV component recycling system in the U.S.; (7) investing in research and development; (8) educating consumers; (9) improving availability, variety, and affordability of EVs; and (10) holding ourselves collectively accountable to metrics and milestones that align with state and nationwide sales targets of EVs. These actions are more thoroughly described in Appendix II, "Achieving Electrification Success Through Cooperation

[5] *E.g., Ford, GM and Stellantis Joint Statement on Electric Vehicle Annual Sales*, GM Corporate Newsroom (Aug. 5, 2021), https://media.gm.com/media/us/en/gm/home.detail.html/content/Pages/news/us/en/2021/aug/0805-electric.html (accessed Oct. 14, 2021).

[6] *Automakers and Suppliers Need to Adopt 'All-New Ways of Doing Business' to Master the Conversion to Electric Vehicles, Materials Shortages, the Rise of New Entrants and Other Disruptors Such as Autonomy and Connectivity, Says AlixPartners Analysis*, AlixPartners (Jun. 17, 2021), https://www.alixpartners.com/media-center/press-releases/2021-alixpartners-global-automotive-outlook/ (accessed Sep. 14, 2021).

[7] *Hot, New Electric Cars That Are Coming Soon*, Consumer Reports (Dec. 30, 2019, updated Sep. 9, 2021), https://www.consumerreports.org/hybrids-evs/hot-new-electric-cars-are-coming-soon-a1000197429/ (accessed Sep. 14, 2021).

[8] CAFE NPRM (*supra* note 2) at 49760 *et seq.*, Tables V-15 and V-18.

[9] *Electric Vehicles Sales Dashboard*, Alliance for Automotive Innovation, https://www.autosinnovate.org/resources/electric-vehicle-sales-dashboard (accessed Sep. 24, 2021), at Explore the Electric Vehicle Sales Dashboard, ATV Market Share, Registration Month Jan. 2020 to Dec. 2020, Filter FCEV, BEV, PHEV, hereinafter "*Electric Vehicle Sales Dashboard*."

and Shared Responsibility." Automobile manufacturers, suppliers, and technology companies have a role to play, but we cannot do it alone.

Coordination and Harmonization of the NHTSA CAFE and EPA GHG Standards

Auto Innovators generally supports EPA's proposed GHG standards with appropriate and necessary flexibilities included in the program.[10] However, we are concerned about the proposed level of CAFE stringency.

It is essential for EPA and NHTSA (collectively "the Agencies") to coordinate with each other in preparing their respective rules through MY 2026 and to set harmonized standards. Given their differing regulations and statutes, the Agencies should make every effort to reduce and avoid unnecessary burdens associated with multiple regulations that ultimately affect light-duty vehicle design in the same ways.[11] The Agencies have historically recognized these differences, leading to CAFE and GHG regulations that are offset by roughly the level of air conditioning ("A/C") technology credits that EPA included, but that NHTSA did not, in their respective programs.[12] In addition to A/C technology credits, the growing and projected adoption of EVs exacerbates the compliance differences caused by EPA and NHTSA's treatment of EVs, leading to stringency differences beyond the A/C credits that have not previously been considered, but that are increasingly important. By MY 2025, NHTSA's proposed requirements become more stringent than EPA's proposal net of these differences. Plus, statutory limitations for credit transfers, the split of the passenger car fleet into import and domestic fleets, and minimum domestic passenger car standards create additional unquantified stringency in the CAFE program relative to the GHG program. To alleviate regulatory burden and reduce duplicative efforts by way of harmonization of the NHTSA and EPA standards, NHTSA could consider a provision under which compliance with EPA's GHG standards would constitute compliance with the CAFE standards. Auto Innovators would be happy to discuss this concept further with you.

Please see Appendix III, "Coordination and Harmonization of the NHTSA CAFE and EPA GHG Standards," for details.

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[10] *See*, *Comments on EPA GHG Proposed Rule for MYs 2023-2026*, Alliance for Automotive Innovation (Sep. 27, 2021), Docket ID NHTSA-2021-0053-0021 at 9 *et seq*., hereinafter "*Auto Innovators GHG Comments*."

[11] *See,* Letter from Alliance for Automotive Innovation to DOT Secretary Buttigieg and EPA Administrator Regan, "Harmonization of Corporate Average Fuel Economy (CAFE) and Light-Duty Vehicle Greenhouse Gas Stringency" (Jun. 28, 2021).

[12] In the MY 2012-2016 standards, NHTSA included neither direct A/C emissions technology credits nor A/C efficiency technology credits. For MYs 2017 and later, NHTSA does not include direct A/C emissions technology credits, but has adopted A/C efficiency technology credits parallel to those in the EPA GHG program.

NHTSA's Consideration of Electric Vehicles in Standard-Setting

Auto Innovators discusses NHTSA's various considerations of electric vehicles in standard-setting in Appendix IV. The following is a brief summary.

Inclusion of Electric Vehicles in the Evaluation of Maximum Feasible Standards

NHTSA's proposed standards improperly consider sales and compliance benefits of electric vehicles in ways prohibited under the Energy Policy and Conservation Act ("EPCA") of 1975, as amended by the Energy Independence and Security Act ("EISA") of 2007.[13] Despite the prohibitions of 49 U.S.C. § 32902(h)(1) and (2), NHTSA considers California's zero-emission vehicle mandate ("ZEV Mandate")[14] in its baseline regulatory scenario, simulates manufacturer compliance with the proposed standards by adding additional EVs beyond even those required by the ZEV Mandate, and includes the alternative fuel benefits of dedicated and dual fueled vehicles in fleet fuel economy estimates. Auto Innovators recommends that NHTSA revise its approach to omit EVs in its standard-setting technical analysis and thereby from its consideration of maximum feasible standards. Doing so would likely yield regulations that appropriately incentivize EV technology as intended by Congress, and would help address harmonization issues with the proposed EPA GHG regulations as discussed above.

Electrification as an Attribute

Auto Innovators supports the choice of footprint as the sole attribute on which the proposed standards are based. This approach continues to serve the CAFE program's primary objective well, namely energy conservation.[15] The footprint-based standards have resulted in improved energy efficiency across the fleet while accounting for market changes. NHTSA now proposes a concept to consider electrification as a vehicle attribute. The actions considered to add electrification as an attribute would suffer from the same legal infirmities as NHTSA's inclusion of the ZEV Mandate and additional EVs for the purposes of compliance with the proposed CAFE standards by considering EVs in standard-setting. Correcting the flaws in the considered approach would result in setting standards similarly, or in the same manner as has historically been done since the inception of an attribute-based standard system.

The Proposed Standards

Given the concerns raised with harmonization of the GHG and CAFE standards, and the requirement for NHTSA to exclude EVs from its analysis of maximum feasible standards in contrast with EPA's considerations, we believe it would be appropriate for NHTSA to finalize less stringent standards than those proposed, yet still more stringent than the standards

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[13] Codified as Chapter 329, Title 49 U.S. Code.

[14] 13 C.C.R. § 1962.2.

[15] *Ctr. for Biological Diversity v. NHTSA*, 538 F.3d 1172, 1194-95 (9th Cir. 2008).

originally finalized in 2020. Furthermore, we agree with NHTSA's assessment that Alternative 3, a more stringent alternative than that proposed, is beyond maximum feasible based on economic practicability concerns as described by NHTSA. We also support NHTSA's continuation of accounting for uncertainty in the projection of future fuel economy standards when setting minimum domestic passenger car standards.

In Appendix V, "The Proposed Standards and Other Standard-Setting Considerations," Auto Innovators provides additional analysis that could support a finding that standards harmonized with the EPA GHG proposal are appropriate and the maximum feasible. These include concerns with the payback period associated with many technologies modeled for compliance with the proposed Alternative 2 and the more stringent Alternative 3. In Alternative 2, over 27% of MY 2026 vehicle models adopt fuel saving technologies that take eight or more years to pay back. (Elsewhere NHTSA estimates new-vehicle customers are willing to pay for technologies that have a 2.5 year payback.) In the more stringent Alternative 3, with the Global Insight fuel prices projections, 1 in 4 vehicles will take at least 12 years to pay back the cost of the added fuel-saving technologies. We also discuss lead-time for technology application. The proposed Alternative 2 is modeled as requiring significant technology additions as soon as MY 2023 (including large numbers of EVs) to support compliance in MYs 2024-2026, despite MY 2023 potentially beginning as soon as two months from now for some vehicle models, and more generally about nine months from now for most.

<u>NHTSA's Statutory Considerations</u>

NHTSA is charged with considering technological feasibility, economic practicability, the effect of other motor vehicle standards of the Government on fuel economy, and the need of the United States to conserve energy.[16] In evaluating the need of the United States to conserve energy, NHTSA has historically included environmental considerations.[17] However, in this rulemaking, NHTSA appears to be taking this consideration a step farther, describing furthering electrification as a policy goal,[18,19] despite statutory prohibitions against considering the benefits of alternative fuels in setting maximum feasible standards.[20] NHTSA is considering such a policy goal in service to achieving deep GHG emissions reductions, an outcome Auto

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[16] 49 U.S.C. § 32902(f).

[17] CAFE NPRM (*supra* note 2) at 49793.

[18] *Technical Support Document: Proposed Rulemaking for Model Years 2024-2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards*, National Highway Traffic Safety Administration (Aug. 2021), hereinafter "*CAFE TSD*" at 25. ("The relevant policy goal is using electrification to achieve deep reductions in GHG emissions.")

[19] CAFE NPRM (supra note 2) at 49631. ("If commenters wish to provide comments on possible changes to the attribute(s) on which fuel economy standards should be based, including approaches for considering vehicle electrification in ways that would further a zero emissions fleet…")

[20] 49 U.S.C. § 32902(h)(1) and (2).

Innovators supports. But one of the central aims of EPA's light-duty vehicle greenhouse gas standards is to reduce emissions of those gases to address climate change concerns, and for NHTSA to allow these same goals to principally drive its rulemaking – and to promote particular technology pathways – is duplicative and confusing. It is not the role of NHTSA to pick technology pathways for reducing energy use and associated greenhouse gas emissions. Although reductions in greenhouse gas emissions are an effect of fuel economy improvements, the primary purposes of the CAFE program are to improve energy efficiency of motor vehicles, and to move the U.S. toward greater energy independence and security.[21,22]

Flexibilities and Compliance

NHTSA is seeking comment on a number of issues related to flexibilities and compliance. Although all of the issues raised by NHTSA are important, our comments focus on three areas: flexibilities, vehicle classification, and the CAFE reporting templates. These issues are explored in greater detail in Appendix VI, "Flexibilities and Compliance."

Flexibilities

In general, Auto Innovators supports NHTSA's inclusion of and coordination with EPA on flexibilities to the extent permitted by statute. We support the continuation of the non-statutory flexibilities including air conditioning efficiency credits, off-cycle technology credits, incentives for strong hybridization[23] of full-size pickup trucks, and incentives that encourage alternative fuels including the 0.15 factor for dedicated and dual-fueled vehicles.

Safety Assessment of Off-Cycle Credits

NHTSA has proposed new processes to review applications for off-cycle fuel economy improvement credits in order to assess the safety of the proposed technology and to remove credits if a safety defect is identified. Auto Innovators understands that NHTSA's primary mission is safety and applauds the agency's commitment to ensuring that technology intended to enhance fuel efficiency does not impair safety. However, NHTSA's proposal goes too far – a technology can be "defective" for reasons unrelated to safety or fuel economy. NHTSA's criterion "identified as a part of NHTSA's safety defects program"[24] is unclear, as is the context

[21] Energy and Policy Conservation Act of 1975 (EPCA) § 2. ("The purposes of this Act are - … (5) to provide for improved energy efficiency of motor vehicles…")

[22] Energy Independence and Security Act of 2007 (EISA) preamble. ("To move the United States toward greater energy independence and security, …to increase the efficiency of … vehicles …")

[23] Or over-performance to footprint-based targets by 20% or more.

[24] CAFE NPRM (*supra* note 2) at 49859. (Proposed 49 C.F.R. § 531.6(b)(3)(iii)(A).)

of "performing as intended."[25] The proposal to require manufacturers applying for off-cycle credits to state that each vehicle equipped with the off-cycle technology will comply with all applicable Federal Motor Vehicle Safety Standards ("FMVSSs") is unnecessary, and it is unclear how the requirement to describe fail-safe provisions will work as a practical manner. Please see our comments in Appendix VI regarding "Safety Assessment of Off-Cycle Credits" for details.

Off-Cycle Technology Fuel Consumption Improvement Values

Auto Innovators supports an increase in EPA's off-cycle technology menu credit cap,[26] but opposes tying it to modified technology definitions. We also support timely additions to the credit menu, which increases regulatory efficiency, but the credit cap should be increased when technology is added. Regarding changes to technology definitions, off-cycle technologies that meet the current definitions still provide on-road fuel economy benefits beyond those observed in standard test cycles, and should therefore continue to be recognized with fuel consumption improvement values ("FCIVs"). To the extent new definitions are desired, separate credit values should be developed and lead-time provided for the development of systems that meet the new definitions. Auto Innovators provided more specific comment to EPA on these issues.[27]

NHTSA is also proposing to impose new deadlines associated with off-cycle technology FCIVs applied for under the "alternative method" pathway. Although we agree that implementation of the alternative method pathway has been time-consuming and has not met the expectations of the Agencies, automobile manufacturers, and suppliers, it is unclear if the imposition of additional deadlines will result in improvements, or simply add additional administrative burden to an already cumbersome process. The Agencies already took steps to improve the timeliness of the process in the 2020 SAFE Rule.[28] NHTSA should allow these process improvements to play out before imposing additional, unilateral deadlines.

A/C Efficiency FCIVs

Auto Innovators supports the continuation of A/C efficiency FCIVs in coordination with EPA. We believe that there is greater room for improvement of A/C system efficiency than is recognized by the cap, as Auto Innovators has demonstrated to the Agencies in recent comments

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[25] *Ibid.*

[26] *See* 40 C.F.R. § 86.1869-12(b).

[27] *See Auto Innovators GHG Comments* (*supra* note 10) at 21 *et seq.*

[28] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks; Final Rule, 85 Fed. Reg. 24174 (Apr. 30, 2020), hereinafter "2020 SAFE Rule."

on off-cycle A/C efficiency technologies,[29] and the practice of capping innovative new A/C efficiency technologies under the menu cap can only serve to discourage further innovation in this area. The Agencies should consider expanding the menu cap and/or discontinue the practice of including new technologies under the cap.

Full-Size Pickup Truck Hybrid and Advanced Technology FCIVs

We support NHTSA's proposal to extend full-size hybrid pickup truck FCIVs in coordination with EPA's proposal. While several automobile manufacturers have announced plans or are actively launching fully electric pickup trucks, these are likely to remain a small fraction of overall pickup truck sales in the near-term. Improving internal combustion engine ("ICE") pickups will remain important, at least in the near-term.

Vehicle Classification

NHTSA discusses potential changes to the off-highway dimensional criteria for CAFE light truck classification,[30] their measurement, and field verifications thereof. Also considered are changes to the definition of a multipurpose passenger vehicle ("MPV").

Production Measurements for Characteristics Indicative of Off-Highway Operation

Auto Innovators reminds NHTSA that the off-road dimensional characteristics are minimum ground clearances and minimum clearance angles. As such, it makes sense to only require reporting of which off-highway characteristics are claimed. We believe that measurements based on engineering designs are appropriate so long as production vehicles are consistent with them and meet the minimum clearance and clearance angle requirements claimed. We also recommend that NHTSA continue its practice of allowing manufacturers to subdivide vehicle models into light trucks and passenger cars. Where multiple suspension modes are available on a vehicle, we recommend that manufacturers report, and that NHTSA measure, off-road dimensional characteristics in the highest ride height setting recommended for off-road use because these features provide additional off-road capability when needed.

Field Audit of Off-Highway Operation Dimensional Characteristics

NHTSA should make complete test procedures available for review and comment prior to their adoption. Test procedures should also be designed to verify compliance to the minimum clearances and clearance angles and account for measurement uncertainty. Vehicles selected for field audits need to be free from any dealer or aftermarket alterations that may affect the off-highway dimensional characteristics of the vehicle.

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[29] *See Auto Innovators GHG Comments* (*supra* note 10) at 26 *et seq*.

[30] 49 C.F.R. § 523.5(b)(2).

Front and Rear Axle Clearance Criteria

NHTSA suggests that the definition of "axle clearance" may be outdated as a result of adoption of independent suspension systems and other factors, but proposes to modify reporting requirements and to adopt novel measurement procedures instead of changing the regulation itself. NHTSA's reasoning and its proposed approach to address the perceived issue are both flawed. The use of an independent suspension system with components that may extend below the level of the front and/or rear differential in and of itself does not indicate that a vehicle is not capable of off-highway operation. Furthermore, a change to the off-highway criteria, whether affected through a direct change to the definition, or through reporting and test procedures should be undertaken with a reasoned analysis of data subject to notice and comment rulemaking procedures. Doing otherwise would violate the strictures of the Administrative Procedures Act ("APA"). In any case, changes in the interpretation or enforcement of axle clearance requirements would require significant lead-time to allow manufacturers to adapt or redesign suspension systems to the new requirements.

49 C.F.R. § 571.3 Definition of Multipurpose Passenger Vehicle

Auto Innovators opposes the linkage of the FMVSS definition of a MPV to the CAFE off-highway dimensional criteria. NHTSA has not described any safety need to link the definition of MPV with the CAFE criteria, and no reasoning for such a change is provided except to address "uncertainty" that does not, in our view, exist. On the contrary, Auto Innovators finds the current interpretations of the definition to be well-understood among industry. Changing the definition of safety vehicle classifications goes beyond the scope of the CAFE regulations and could result in significant vehicle redesigns which have not been considered in this rulemaking. Any changes to safety vehicle classifications should be addressed in their own rulemaking with rationale and cost/benefit analysis. In addition, making such a linkage could cause other unintended consequences, which would have to be considered in the stringency of CAFE standards, such as eliminating certain off-cycle technology FCIVs from vehicles that would be otherwise classified a MPV.

<u>CAFE Reporting Templates</u>

NHTSA requests comment on CAFE reporting templates including the CAFE Credit Value Template, the CAFE Projections Reporting Template, and the CAFE Credit Transaction Template. With regard to the CAFE Credit Value template, the data required fails to achieve NHTSA's stated objectives, is unnecessary to the administration of the CAFE program, and is explicitly prohibited from consideration in standard-setting processes.[31] In short, in our view, the data requested in the Credit Value Template exceeds NHTSA's statutory authority. Additionally, we are concerned with the potential, unintended disclosure of confidential business information through the CAFE Projections Reporting Template. Additional

[31] 49 U.S.C. § 32902(h)(3).

descriptions of these issues and technical comments related to the CAFE reporting templates are also provided in Appendix VI.

Comments on Analysis of Benefits and Costs

Auto Innovators provides extensive comments on the Agencies' analysis of benefits and costs in Appendix VII, "Comments on NHTSA's (and EPA's) Analysis of Benefits and Costs." The following is a short summary of the detailed comments therein.

Analysis of Benefits

Private Fuel Savings

The CAFE Compliance and Effects Modeling System ("CAFE Model") assumes manufacturers will adopt technologies, absent regulation, that pay for themselves within 2.5 years of vehicle ownership. Overall, given that the existing body of evidence about consumer valuation of fuel economy does not reach definitive findings, a sensitivity-analysis approach to the 2.5-year payback period may be warranted.

Concerning energy savings associated with electric vehicles, there is a tremendous amount of uncertainty and geographic variability related to the future of the electricity grid, and electricity rates. Auto Innovators urges policymakers to consider the possibility that electricity rates may become considerably more expensive as renewable generation is added. The Agencies should also consider how EVs may be operated differently than their ICE counterparts.

Forecasts for conventional fuel prices are also uncertain. Despite recent rises in the price of gasoline, historically forecasts have overestimated the national average price of conventional fuels. We urge the Agencies to review the assumptions underlying the Energy Information Administration ("EIA") gasoline price forecast, and if the EIA gasoline price forecast assumes fewer than 50% plug-in vehicles by 2030 (the goal set by the Biden Administration), Auto Innovators encourages use of the Global Insight gasoline price forecast in the Central Case for both EPA and NHTSA analysis. Policymakers should carefully consider the possibility that gasoline prices will not increase significantly past 2030, and the impacts that would have on longer-term projections of private benefits from fuel savings.

GHG Emissions Benefits

The proposed rulemakings do not include recent advances in scientific analysis of the social cost of carbon ("SCC"). Before the Agencies consider any changes in the SCC, we urge the Administration to undertake a rigorous process that includes independent scientific peer review and ample opportunity for public comment. The Agencies should also use consistent discount rates for costs and benefits in any given calendar year.

Local Air Quality Benefits

Although local air quality benefits do not play a major role in the benefit and cost analysis, the analysis of them could be improved. There are apparent inconsistencies between assumptions made for changes in upstream U.S. oil production, refining, and transportation, and assumptions made in the energy security benefits analysis regarding oil imports. Such inconsistencies should be resolved. There are also large variations in the ratio of climate-related benefits to air quality benefits, both between the Agencies and relative to peer-reviewed scientific literature. The Agencies should determine the causes of these differences and make any necessary changes. In addition, the Agencies seem to fail to consider how tailpipe and stationary pollutant control regulations may affect the evaluation of health benefits associated with reduced consumption of fuels in light-duty vehicles. Auto Innovators recommends that the Agencies reevaluate their analyses in light of the more specific comments provided in Appendix VII.

Energy Security Benefits

Auto Innovators agrees with the thrust of the Agencies that energy security benefits are a less compelling rationale for the proposed standards and for the transition to EVs than they were when the CAFE program was created in 1975, and even when the Obama-era standards were finalized in 2012. This, of course, would weigh in favor of less stringent CAFE standards since the primary policy benefit supporting stringent fuel economy standards is the need of the nation to conserve energy. We did notice some subtle inconsistencies in how the Agencies analyzed energy security benefits. Auto Innovators is also not fully convinced that a decrease in U.S. gasoline consumption will impact oil imports to the U.S. rather than U.S. oil producers and refiners. The Agencies should provide a rigorous analysis of which oil producers and refiners in the world will be adversely impacted by an incremental decline in U.S. demand for oil to support their assumptions. This issue will be even more important in future rulemakings insofar as the agencies estimate much larger reductions in gasoline consumption.

<u>Analysis of Costs</u>

Rebound Effects

The Agencies recognize that some consumers may respond to the lower operating costs of fuel-efficient vehicles by increasing their amount of vehicle travel. The Agencies wisely take a sensitivity analysis approach to the magnitude of this effect, since rebound effects are difficult to estimate with a high degree of precision. We suggest that the Agencies also consider "attribute substitution" affects (wherein households buy and use vehicles with differing fuel economy attributes to suit their needs, *e.g.*, a large SUV and a midsize car) in the consideration of rebound.

Technology Costs of Electric Vehicles

The Agencies assume significant cost decreases in battery electric and other electric vehicles through 2032. However, several cost factors need to be considered more thoroughly including raw material costs, the effect of potentially higher electricity costs on electric vehicle production, and how variations in battery cell chemistry, form factor, and pack design could affect cost learning assumptions. There are also likely near-term costs to develop the necessary supply chains. We suggest that, at minimum, the Agencies adopt a two-part learning curve for batteries that separates raw material costs from time/volume learning such as that described by MIT Energy Initiative (2019).[32]

User Costs of Electric Vehicles

Electric vehicle users can also incur costs beyond that of the technology itself. While some of these costs are considered, we urge the Agencies to also consider costs such as those for home charging infrastructure, and cost/benefit differences for long-range and short-range electric vehicles. Electrification technologies, especially BEVs and PHEVs, entail a significant change in how motorists engage with transportation and electric-utility systems.

Employment Impacts of the EV Transition

The proposed GHG and CAFE standards, insofar as they boost the EV transition, will have complex impacts on employment in different sectors and different regions of the country. Auto Innovators recommends that the agencies go beyond their current rudimentary analysis (which considers only new vehicle sales and stimulus of battery manufacturing) and consider employment analysis of each of the following issues.

1. The impacts of EVs on employment at U.S. plants that produce gasoline engines and transmissions, and their supply chains.

2. The impacts of EVs on employment in the U.S. petroleum and biofuels sectors, including their supply chains.

3. The employment impacts of EV production in the U.S. and elsewhere, including effects on U.S. content, accounting for the global geographic distribution of the mining and processing of raw materials, the manufacture of cathodes, anodes, electrolytes and separators, the production of battery cells and the assembly of battery packs, and the production of electric motors and other systems/components (*e.g.*, charging networks) that are critical to EVs.

Comments on Technical Modeling

In Appendix VIII, "Comments on Technical Modeling" Auto Innovators discusses various CAFE Model inputs, CAFE Model operation and features, and interagency coordination in the development of, and inputs for, GHG and fuel economy compliance models.

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[32] *Insights into Future Mobility,* MIT Energy Initiative (2019), Cambridge, MA: MIT Energy Initiative, https://energy.mit.edu/research/mobilityofthefuture/ (accessed Oct. 22, 2021), hereinafter "*Insights into Future Mobility,*" at 76.

Comments on CAFE Model Inputs

Assumptions in the Baseline (No-Action) Alternative

NHTSA includes increased use of off-cycle technology FCIVs, the California Framework Agreements, and the California ZEV Mandate in its baseline. These projections increase the amount of fuel saving technologies projected in the "baseline," independent of CAFE regulations, and, as a result, affect the compliance pathways projected in the CAFE standard-setting runs. The CAFE Model sales module only considers fuel saving technology costs in excess of baseline projections when determining sales impacts. Thus, the inclusion of additional off-cycle technology, the California Framework Agreements, and the ZEV Mandate in the baseline increases fuel economy, but the associated increased vehicle costs do not affect the sales forecasts or fleet turnover projections. As a result, sales impacts may be understated in some scenarios by a factor of more than two. NHTSA should address this apparent disconnect between the sales module and baseline assumptions to develop a more realistic assessment.

Manufacturer Willingness to Pay CAFE Civil Penalties

Inputs for assumed manufacturer willingness to pay CAFE civil penalties do not always appear logical given higher anticipated future penalty rates and participation of some companies in California Framework Agreements. The input settings used lead to projected compliance pathways with lower penetration rates of technology than would otherwise be modeled. NHTSA should, at minimum, provide a sensitivity analysis to these assumptions.

Potential Future Technology Additions

Auto Innovators provides several comments on considerations for future technology additions to the CAFE Model. First, technology modeling should be performance-neutral, or acknowledge that vehicles are generally improved over time. To the extent NHTSA may be considering them, we discourage the addition of 30% tire rolling resistance improvements and greater than 20% aerodynamic resistance improvements to the analysis at this time. Finally, we discourage inclusion of EPA's "HCR2" technology package.

The Scenarios Input File

A number of technical issues related to inputs in the Scenarios input file are provided. We refer you to Appendix VIII for details.

Comments on CAFE Model Operation

The "Standard-Setting" Mode

Unlike prior iterations of the CAFE Model, the latest version of the model allows a user to specify which model years are subject to standard-setting constraints. However, the multiyear planning functions of the model cause it to add EV (and other) technology in advance of or after the standard-setting years, but still in response to more stringent standards. When combined with civil penalty payment assumptions, the current approach leads to unprecedented projected adoption of battery electric vehicles in MY 2023 as part of the projected compliance pathway to improve fleet fuel economy for the 2024-2026 CAFE standards. The Standard-Setting Years input settings should take multi-year compliance pathways into account and lead to thoughtful projected compliance pathways, especially with respect to alternative fuel vehicles.

CAFE Model Capability to Simulate Other Standards

The CAFE Model remains a long-standing and well-developed modeling tool for development of fuel economy, and now GHG, standards as well. Auto Innovators was pleased to see that the EPA relied on use of the model for its rulemaking. However, the CAFE Model is, at present, incapable of fully simulating the proposed EPA and California Framework Agreement GHG standards. As a result, Auto Innovators suggests that NHTSA add capability to model differing electric vehicle incentive multipliers ("EV Multipliers") and associated cumulative credit caps on a per manufacturer basis. Such capability may be used for sensitivity studies, environmental impact studies, and to understand total costs of compliance with all regulations related to fuel economy. However, care would be needed to ensure that such capability does not result in the consideration of alternative fuels in determining maximum feasible standards. These additions will support continued use of and reliance on the CAFE Model for future standard-setting.

Interagency Coordination

NHTSA and EPA should better coordinate on common compliance models and inputs to them, building on the expertise of both and in consultation with other federal and state agencies, and national laboratories. While separate modeling to account for differences in statutory authority may still be required, the use of common models and input assumptions will greatly enhance the efficiency of rulemaking. The Agencies should also acknowledge the total regulatory costs associated with simultaneous compliance with federal, state, and legal requirements related to fuel economy. Not doing so ignores the significant overlap between multiple regulatory programs and may mislead policymakers with regard to associated costs and economic practicability.

Technical Issues with Draft Regulatory Text

Notwithstanding our comments on NHTSA's proposals, several technical writing errors are present in the draft regulatory text. Appendix IX calls these issues to NHTSA's attention for correction as appropriate in a final rule.

Appendix I: Our Vision for the Future

Achieving a Net-Zero Carbon Transportation Future

As outlined in greater detail in Appendix IV of these comments, Auto Innovators believes that the proposed CAFE standards and the underlying analyses in the CAFE NPRM and related documents improperly consider the fuel economy of EVs in violation of 49 U.S.C. § 32902(h)(1) and (2). The structure of EPCA—whereby the fuel economy of EVs must be excluded from the standard-setting but are included in a manufacturer's compliance fleet—was intentionally crafted by Congress in order to incentivize automaker investments in the manufacture and sale of such alternative fuel vehicles. As we explain elsewhere in these comments, NHTSA's inclusion of EVs in its standard-setting here, coupled with EPA's different treatment of these vehicles for GHG compliance purposes, has the exact opposite effect. Rather than disincentivize EVs, at a minimum, the CAFE program should not stand as an obstacle to achieving the nation's electrification goals.

Auto Innovators and its members are committed to achieving a net-zero carbon transportation future for America's cars and light trucks. We are ready to be part of a comprehensive, national strategy to transform our vehicles, our manufacturing, our workforce, and our fueling infrastructure to achieve an exciting, electrified future. For over 100 years, the automobile has evolved to meet the changing needs of our country and its users. This industry is poised to deliver the next phase of transformation, electrifying our fleet to achieve net-zero carbon emissions. We are confident that electrification can be successful, and that electrification will deliver mobility services that American families and businesses will benefit from. Together with public and private stakeholders, we can be successful in this transformation.

On the road today, there are over 280 million cars and light trucks[33] supported by a network of nearly 150,000 fueling stations.[34] Americans traveled almost three trillion miles in 2020 alone.[35]

Transforming our light duty fleet to electrification, and creating an ecosystem in which electrification can thrive, is a task that must be accomplished at scale and in a manner that ensures mobility for American families and businesses. This task is not just building great cars and trucks. It starts with securing access to critical raw minerals and establishing a secure

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[33] *U.S. Vehicle Registration Statistics*, Hedges & Company, https://hedgescompany.com/automotive-market-research-statistics/auto-mailing-lists-and-marketing/ (accessed Sep. 22, 2021).

[34] *Service Station FAQs*, American Petroleum Institute, https://www.api.org/oil-and-natural-gas/consumer-information/consumer-resources/service-station-faqs (accessed Sep. 22, 2021).

[35] *Moving 12-Month Total Vehicle Miles Traveled [M12MTVUSM227NFWA]*, U.S. Federal Highway Administration, retrieved from FRED, Federal Reserve Bank of St. Louis, https://fred.stlouisfed.org/series/M12MTVUSM227NFWA (accessed Sep. 22, 2021), Dec. 2020 datapoint.

network of logistics and processing that will deliver the flow of materials to new and retooled factories that will manufacture advanced batteries and electric drive components. Furthermore, we must train our workforce to build, service, and repair electric vehicles. We must also ensure that the vehicles are handled responsibly at end of life and that critical minerals circulate back into the economy. Our service stations will also need to evolve in order to fuel these new vehicles with electrons and hydrogen. Energy producers must also move in tandem to ensure that the new fuels are sourced from renewables and can be delivered affordably and at scale to our consumers and businesses. Automakers are committed to doing our share. Collectively, automakers have committed to investing more than $330 billion to transforming cars and trucks to an exciting, electrified future.[36] We believe electric vehicles powered by clean electricity, renewable hydrogen and other low- and net-zero carbon fuels will help deliver our contribution to our nation's ambitious climate goals.

We will be successful in this endeavor when we are aligned and moving forward together to achieve our shared goal of cleaner, safer, and smarter vehicles.

President Biden's Vision for a Low Carbon Future

From day one, President Biden has provided this industry with a clear vision to achieve a low-carbon transportation future for American families and businesses. The President has reestablished connections with his partners in the States, many of whom have been active in establishing decarbonization efforts within their own boundaries. He has refocused the efforts of executive branch agencies to develop near- and long-term proposals to reduce carbon emissions and further enhance energy security for our cars and trucks. The President has demonstrated an "all-of-government" approach in seeking to implement climate policies throughout the Executive Branch. Furthermore, the proposals in the President's signature Build Back Better plan, combined with the bipartisan Infrastructure Investment Agenda, are seeking to commit once-in-a-generation levels of investment into America's manufacturing, fueling, and roadway infrastructure, and in helping consumers transition to new electric vehicles.

Combined, these efforts demonstrate the sheer scale of work needed to align and fund the many sectors that will be involved in achieving and supporting the successful transformation of our vehicles to electrification. Ambitious regulatory programs coupled with equally ambitious national investment plans signal the level of commitment needed to continue and accelerate our path to achieving our nation's climate goals.

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[36] *Automakers and Suppliers Need to Adopt 'All-New Ways of Doing Business' to Master the Conversion to Electric Vehicles, Materials Shortages, the Rise of New Entrants and Other Disruptors Such as Autonomy and Connectivity, Says AlixPartners Analysis*, AlixPartners (Jun. 17, 2021), https://www.alixpartners.com/media-center/press-releases/2021-alixpartners-global-automotive-outlook/ (accessed Sep. 14, 2021).

Appendix II: Achieving Electrification Success Through Cooperation and Shared Responsibility

Our national success in achieving a zero-emission future is a shared and collective responsibility that will demand immediate and sustained action from many partners. As the President has established an "all of government" approach to addressing climate change, so too must an "all in" approach to transforming America's manufacturing base, workforce, fueling infrastructure and vehicle fleet be established. Necessary actions to support the transition to electric vehicles include, but are not limited to the following.

Supporting American Drivers With Reliable and Convenient EV Refueling Infrastructure

A 2021 National Academies report on improving light-duty vehicle fuel economy (the "2021 NAS Report")[37] cites location and availability of charging stations as the number one reason for a consumer to avoid an electric vehicle.[38] EV recharging and hydrogen fueling infrastructure availability and visibility will be critical to promoting EV market growth and supporting manufacturer sales targets to both meet the proposed standards and long-term electrification goals. Home charging will cover some needs, but not all. State and federal governments, together with private sector charging companies, have the opportunity to establish a fueling infrastructure plan that will provide confidence to American drivers that they will never be afraid of running out of fuel. Auto Innovators supports the National EV Charging Initiative.[39] In the long run, over 250 million light-duty vehicles will need to be supported with convenient, affordable, and reliable electric and hydrogen fueling.

Helping Consumers Bridge Near-Term Cost Premiums With Purchase Incentives

There is much uncertainty regarding EV price parity with ICE vehicles, and while some segments may achieve this earlier than other segments, we do not expect this to occur prior to 2030 for some more popular segments, and likely later for others. Many consumers may be unable, or simply unwilling, to shoulder the higher upfront cost premiums. Purchase incentives help to close the price gap and drive EV sales. A study by Resources for the Future finds that

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[37] *Assessment of Technologies for Improving Light-Duty Vehicle Fuel Economy 2025-2035*, National Academies of Sciences, Engineering, and Medicine, Washington, DC: The National Academies Press (2021), available at https://doi.org/10.17226/26092. Hereinafter "*2021 NAS Report*".

[38] *Id.* at 5-135.

[39] *See EV Charging Initiative,* National EV Charging Initiative, https://www.evcharginginitiative.com/ (accessed Aug. 26, 2021).

federal income tax credits resulted in a 29 percent increase in EV sales.[40] Federal, state, and local governments have the opportunity to put in place rebates and other incentives to drive market share for electric vehicles.

With the goal of significantly increasing the number of EVs on the road, purchase incentives should fully apply to the broadest range of vehicles and be available to the broadest range of consumers. Incentives should be applicable to vehicles produced by all manufacturers (including by raising or eliminating the current per-manufacturer cap), non-discriminatory between companies, and widely available to preserve consumer choice as more EVs come to the market across all models and price points.

Fleet Purchase Requirements

Over 8 million cars and trucks are owned by fleet operators in the U.S.[41] Fleets represent a significant opportunity for electrification given regular routes and often centralized fueling. Federal, state, local, and private fleets have an opportunity to demonstrate leadership in accelerating adoption of EVs. Recently, Auto Innovators wrote to the California Air Resources Board ("CARB") in support of such requirements as part of CARB's ACC2 rulemaking.[42] Fleet purchase requirements are especially logical in jurisdictions that have specific EV sales requirements. Reaching high EV sales goals will require substantial fleet, in addition to retail, market penetration.

Policies to Support Development of EV and Battery Manufacturing and Domestic Supply Chains, Including Critical Minerals

At present, most critical minerals necessary for the production of advanced EV motors and batteries are mined and processed outside of the United States, primarily in China. Additional domestic sources and processing capacity are needed to supply EV production and encourage domestic manufacturing and jobs.

A Nationwide Low Carbon Fuel Standard Program

Low carbon fuel standards are a market-based approach to decarbonizing transportation fuel and driving funds toward incentivizing EVs.

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[40] Jianwei Xing, Benjamin Leard, Shanjun Lee, *What Does an Electric Vehicle Replace?*, Working Paper 19-05, Resources for the Future (Feb. 2019), https://www.rff.org/publications/working-papers/what-does-electric-vehicle-replace/ (accessed Aug. 26, 2021).

[41] *U.S. Automobile and Truck Fleets by Use,* U.S. Department of Transportation Bureau of Transportation Statistics, https://www.bts.gov/content/us-automobile-and-truck-fleets-use-thousands (accessed Sep. 14, 2021).

[42] Letter from Alliance for Automotive Innovation to Richard Corey, Executive Officer, California Air Resources Board, "Zero Emission Vehicles – Requirements for Fleets" (Aug. 20, 2021).

Development of a Battery and EV Recycling System In the United States

As EV manufacturing in the U.S. grows, the demand for critical minerals will as well. In addition, as today's EVs are retired, a robust recycling system is required to ensure valuable components of EVs, such as batteries and the metals within them, are reused and recycled. Auto Innovators is actively working with government and recycling industry stakeholders to develop such a system.

Increased Research and Development Investments

EVs remain relatively more expensive than equivalent ICE vehicles. Significant additional research is required to achieve the cost reductions projected and hoped for.

Consumer Education Programs

Additional consumer education and advertising campaigns can help promote the purchase of EVs.

Continued Actions and Commitments By Automakers to Improve the Availability, Variety, and Affordability of EVs In the United States

Manufacturers are on pace to debut almost 100 pure electric models by the end of 2024.[43]

Metrics and Milestones That Align With Nationwide EV Sales Targets

For the nine above action items, development of specific metrics to track progress and identify milestones linked to EV sales targets will be critical. This will ensure the necessary conditions for success are being developed and provide federal, state, and local governments with guidance on policies and funding needed to expand electrification across the nation.

[43] *Hot, New Electric Cars That Are Coming Soon*, Consumer Reports (Dec. 30, 2019, updated Sep. 9, 2021), https://www.consumerreports.org/hybrids-evs/hot-new-electric-cars-are-coming-soon-a1000197429/ (accessed Sep. 14, 2021).

Appendix III: Coordination and Harmonization of the NHTSA CAFE and EPA GHG Standards

In 2010, EPA, NHTSA, and CARB created the first "National Program" for regulation of fuel economy and GHG emissions. For their part, EPA and NHTSA issued a joint final rule with separate standards that generally accounted for statutory differences, resulting in roughly equivalent required fuel economy improvements under both programs. CARB, for its part, adopted a "deemed-to-comply" provision to its regulations that allowed manufacturers to demonstrate compliance with its regulation by meeting the EPA's GHG regulation. In the words of the Agencies, the National Program allowed "automakers to produce and sell a single fleet nationally, mitigating the additional costs the manufacturers would otherwise face in having to comply with multiple sets of Federal and State standards."[44]

As the National Program signified, coordination among the regulatory agencies can create public and private benefits. Harmonized regulations allow manufacturers to focus their planning and investments to achieve fuel economy and GHG improvements while reducing the added challenge of meeting three differing federal and state regulations across the U.S. Environmental benefits can be achieved at a lower cost to consumers while supporting jobs in manufacturing. Lower costs also result in faster fleet turnover by encouraging more new vehicle sales to replace older vehicles with more efficient, cleaner, and safer new vehicles.

In 2007, the Supreme Court noted that although EPA's obligation to protect the public health and welfare may overlap with NHTSA's obligation to promote energy efficiency, "there is no reason to think the two agencies cannot both administer their obligations and yet avoid inconsistency."[45] It is our belief that, for the current GHG and CAFE rulemakings, such inconsistency is best avoided by coordination between the agencies and harmonization of stringency to the fullest extent possible.[46]

Coordination and harmonization between EPA and NHTSA should result in GHG and CAFE regulations that allow manufacturers to build a single fleet of vehicles that complies with both regulations, and that does not interfere with the other agency's policy goals and statutory obligations. Developing such harmonized regulations requires the Agencies to fully assess their policies in the context of the other's proposal (especially since there is not a unified rulemaking over the covered period due to lead-time constraints). To alleviate regulatory burden and reduce duplicative efforts by way of harmonization of the NHTSA and EPA standards, NHTSA could consider a provision under which compliance with EPA's GHG standards would constitute

[44] Light-Duty Vehicle Greenhouse Gas Emission Standards and Corporate Average Fuel Economy Standards; Final Rule, 75 Fed. Reg. 25324, 25326 (May 7, 2010), hereinafter "2010 Rule".

[45] *Massachusetts v. EPA,* 549 U.S. 497, 532 (2007).

[46] This approach may not hold for subsequent rulemakings as fleet electrification and use of alternative fuels continues to grow.

compliance with the CAFE standards. Auto Innovators would be happy to discuss this concept further with you.

The impact of a lack of harmonization is not just theoretical. To date, no manufacturer has fallen out of compliance with GHG regulations, although, even with record GHG reductions from the auto sector, many manufacturers have now failed to meet annual GHG targets for several years and are relying on previously banked over-compliance credits to remain compliant.[47] In contrast, manufacturers have paid civil penalties of approximately $193 million for non-compliance with CAFE regulations between model years 2012 and 2017, even as the industry sets records when it comes to ICE efficiency.[48]

Coordination

It is clear from the Agencies' proposals and supporting analyses that coordination in preparing the proposals was minimal. The Agencies use different versions of the CAFE Model, begin their analysis with different model year vehicles, and even use different assumptions for what the future mix of vehicles will look like. More importantly, the Agencies both fail to analyze how automakers would comply with the other's proposal, increasing the risk that one agency's proposal may be inconsistent with the other's. Coordination between the Agencies should be improved in the development of final GHG and CAFE rules for model years 2023-2026.

Harmonization

Auto Innovators considered six key statutory and regulatory differences between the EPA GHG and NHTSA CAFE programs. These differences, described in further detail below, include direct A/C emissions credits; the Agencies' treatment of electric vehicles, including compliance valuation and production incentives (*i.e.*, EV Multipliers); CAFE minimum domestic passenger car standards; CAFE credit transfer caps; CAFE credit banking provisions (carry-forward/carry-back); and the CAFE split of passenger cars into domestic and import fleets.

The impact on stringency of the direct A/C emissions credit and the compliance treatment of electrified vehicles can be easily quantified. Auto Innovators has performed such an analysis based on NHTSA's modeling of its proposed standards. We find that the proposed NHTSA CAFE standards are effectively more stringent than the proposed EPA GHG standards. If left uncorrected, the CAFE program would require more technology for compliance than the

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[47] *The 2020 EPA Automotive Trends Report: Greenhouse Gas Emissions, Fuel Economy, and Technology Since 1975*, U.S. Environmental Protection Agency (Jan. 2021), https://www.epa.gov/automotive-trends (accessed Jun. 17, 2021), hereinafter "EPA Trends Report".

[48] *MY 2019 Industry CAFE Compliance*, National Highway Traffic Safety Administration (Oct. 15, 2019), https://one.nhtsa.gov/cafe_pic/AdditionalInfo.htm ("MY 2011 - MY 2019 Credit Shortfall Report") (accessed Jun. 17, 2021).

GHG program. It would also effectively negate EPA's proposed policy actions to incentivize greater production of electric vehicles, in direct contravention to the Biden Administration's goal of more rapid deployment of such vehicles. Given the 49 U.S.C. § 32906(h)(1) and (2) prohibitions against NHTSA's consideration of the use of alternative fuels in determining maximum feasible CAFE standards, and EPA's consideration of electric vehicles in proposing revised standards for MYs 2023-2026, it is logical to conclude that the appropriate approach to harmonizing the CAFE standards with the GHG standards is to reduce the level of CAFE stringency from that proposed. We recommend that NHTSA consider this and adopt final CAFE standards that do not require additional technology adoption beyond the pending GHG standards and that preserve incentives intended to encourage the production of EVs.

The impact on harmonization from the other statutory and regulatory differences is more difficult to quantify. However, it is clear that, directionally, each of these differences makes compliance with the NHTSA CAFE program more difficult and, at minimum, add complexity to compliance plans. These differences add costs, and as noted above, have directly resulted in the payment of CAFE civil penalties despite ongoing compliance with EPA regulations. We recommend that NHTSA consider these differences to the EPA program and their impacts on regulatory costs as part of its evaluation of the economic practicability of CAFE standards.[49]

<u>Statutory and Regulatory Differences Between EPA GHG and NHTSA CAFE</u>

The Agencies should consider these differences in the development of harmonized regulations.

1. Direct air conditioning emissions credit. EPA's underlying statutes allows it to adopt regulations that provide a credit for reducing the leakage of air conditioning system refrigerants and for the substitution of lower global warming potential refrigerants. NHTSA's statute focuses exclusively on energy conservation, precluding NHTSA from adopting a similar credit. To address this difference, NHTSA CAFE standards have been offset from EPA GHG standards by approximately the level of anticipated use of air conditioning system refrigerant leakage credits. This practice should be continued.

2. Treatment of electric vehicles. EPA's statute allows it to correctly assign a "zero" GHG tailpipe emissions value for electric vehicles. In contrast, CAFE fuel economy is an energy-equivalent calculation, including an incentive for the use of an alternative fuel. The CAFE calculation results in a relatively high fuel economy level that is nevertheless not equivalent to the tailpipe emission value of zero. Further, the current and proposed GHG program provides a production multiplier to encourage electric vehicle production that is not included in the CAFE statute. Past joint GHG/CAFE rulemakings have acknowledged the

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[49] *See* Letter from Alliance for Automotive Innovation to DOT Secretary Buttigieg and EPA Administrator Regan, "Harmonization of Corporate Average Fuel Economy (CAFE) and Light-Duty Vehicle Greenhouse Gas Stringency" (Jun. 28, 2021).

statutory difference in the treatment of electric vehicles can affect program stringency. However, it is unclear how much of an adjustment has been applied to account for the greater GHG program flexibility. A clearly defined offset will become critical to address these differences as manufacturers strive to increase the market share for electric vehicles.

3. Minimum domestic passenger car standards. The CAFE statute requires NHTSA to set a non-attribute-based standard for the domestic car fleet, further increasing compliance burdens. EPA's statute has no such requirement, nor should EPA adopt one in regulation.

4. CAFE credit transfer cap. EISA created a flexibility to transfer CAFE credits from one compliance fleet to another, but limits such transfers. This cap constrains manufacturers from moving credits from one fleet to another despite the preservation of total fuel savings. In addition, the constraint of the cap increases over time as fuel economy standards and performance rise.[50] This results in less flexibility and greater compliance challenges in the CAFE program. These limitations do not exist (and should not be created) in the GHG program.

5. CAFE credit carry-forward and carry-back. CAFE regulations do not adjust credit values to preserve fuel savings when credits are simply carried forward or back. This practice discounts the fuel savings associated with over-complying with CAFE standards in earlier years. In contrast, EPA credit accounting preserves tons of avoided emissions regardless of how and when the credits are used. In addition, the CAFE statutes require a five-year credit carry-forward and three-year credit carry-back life. In contrast, EPA has historically provided a longer credit carry-forward period and proposes to adopt similar provisions in the GHG NPRM.

6. Passenger car standards. The CAFE statute splits passenger cars into domestic and import fleets, exacerbating the constraints created by credit transfer caps. EPA's statute does not require this split, nor should EPA adopt such a split by regulation.

[50] Fuel economy (miles per gallon) is not linear to fuel consumption (gallons per mile). As fuel economy increases, the actual fuel savings associated with a mile per gallon become smaller. Thus, a cap defined in miles per gallon (as in 49 U.S.C. § 32903(g)(3)) becomes more constraining over time as NHTSA adopts more stringent fuel economy standards.

Harmonization of the NHTSA CAFE and EPA GHG Proposals

Harmonization in Prior Rulemakings

Compared to the past three light-duty rulemakings (*i.e.*, in 2010, 2012, and 2020), the 2021 NHTSA CAFE proposal is less harmonized to the EPA GHG proposal. In the previous rulemakings, the Agencies finalized regulations that were generally offset by the projected amount of A/C technology credits not included in the CAFE regulation so that automobile manufacturers could largely comply with both the GHG and CAFE regulations with relatively few adjustments in applied fuel economy technologies.[51] The simplest way to see the relative numerical stringency difference between the GHG and CAFE regulations is to compare the Agencies' estimates of industry-average GHG targets, account for the A/C system improvement credits not included in the CAFE program in a given model year,[52] and convert to common units (*e.g.*, grams per mile) assuming 8,887 g CO_2 per gallon conventional fuel.

The past three rulemakings each had relatively close links between the Agencies' projected GHG and CAFE targets. Figure III-1 shows projected fleet average targets in the Obama Administration's rulemakings for MYs 2012-2016 ("2010 Rule")[53] and MYs 2017-2025 ("2012 Rule").[54] The chart shows the projected GHG targets (in blue), air conditioning credits not included in the CAFE program (in orange), and CAFE targets (in black). The left side is for passenger cars, the right side is for light trucks. A perfect match between the programs would have the black lines identical to the top of the orange A/C credits—which would mean a GHG-compliant fleet is a CAFE-compliant fleet, assuming other harmonization issues are not constraining. The average difference between the CAFE compliant line and the GHG-plus-air-conditioning line is 1.9 g CO_2e /mile (0.5 MPG) for passenger cars and 0.1 gCO_2e /mile (0.02 MPG) for light trucks.

[51] This approach addressed the relatively easy to quantify A/C technology credits, but did not address other harmonization issues such as credit transfer caps and the minimum domestic passenger car standards, which has ultimately led to a situation wherein some manufacturers remain compliant with GHG regulations, but have been required to pay civil penalties resulting from non-compliance with CAFE standards.

[52] These include direct A/C emissions credits in MYs 2012-2026 and A/C system efficiency credits in MYs 2012-2016.

[53] 2010 Rule (*supra* note 44).

[54] 2017 and Later Model Year Light-Duty Vehicle Greenhouse Gas Emissions and Corporate Average Fuel Economy Standards; Final Rule, 77 Fed. Reg. 62624 (Oct. 15, 2012), hereinafter "2012 Rule".

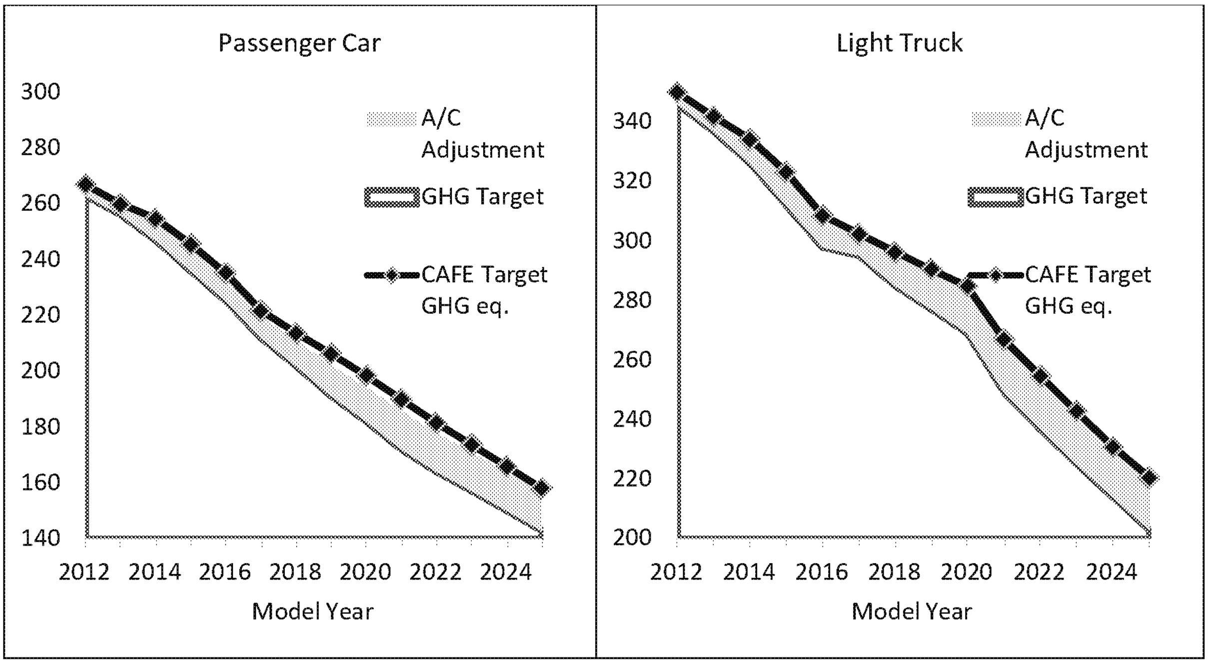

Figure III-1: GHG to CAFE Target Comparison (Net of A/C Credits not Included in CAFE Program), Obama Administration Rulemakings, MYs 2012-2025, Passenger Cars and Light Trucks[55]

In the more recent 2020 SAFE Rule for MYs 2021-2026, similarly, there is a relatively close match between GHG and CAFE targets after considering direct A/C emissions credits. Figure III-2 shows this relationship, using the same conventions as described for Figure III-1. The average difference between the CAFE targets and the GHG-plus-direct-air-conditioning targets is 2.5 gCO_2e/mile (0.6 MPG) for passenger cars and 0.1 gCO_2e /mile (0.0 MPG) for light trucks.

[55] Graphics by author based on data from 2010 Rule (*supra* note 44) at 25330 (Table I.B.2-1), 25331 (Table I.B.2-4), and 25372 (Table II.D-1) (model years 2012-2016); and 2012 Rule (*supra* note 54) at 62640 (Table I-1), 62641 (Table I-4), and 62805 (Table III-14) (model years 2017-2025).

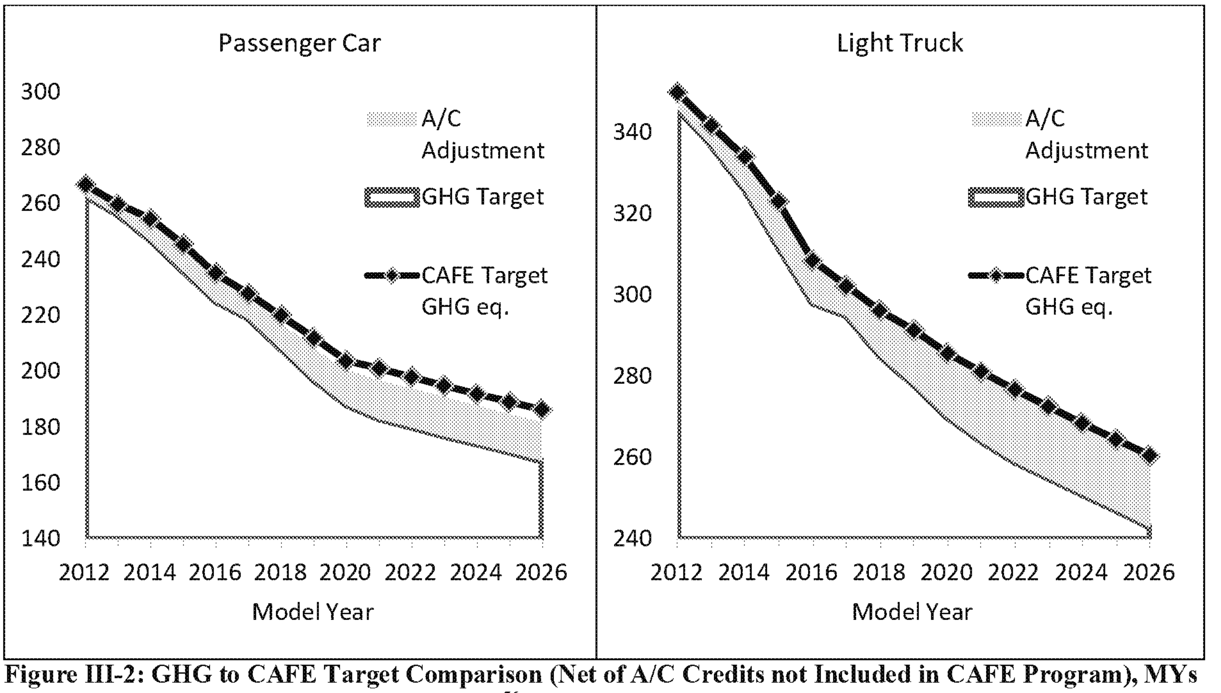

Figure III-2: GHG to CAFE Target Comparison (Net of A/C Credits not Included in CAFE Program), MYs 2012-2026, Passenger Cars and Light Trucks[56]

Harmonization in the Present Rulemakings

Auto Innovators performed a similar assessment of the harmonization between the now proposed CAFE and GHG standards. Given manufacturer announcements of additional EVs and NHTSA's projections for increasing EV technology penetration in the fleet,[57] differences between CAFE and GHG compliance resulting from compliance calculation differences (the petroleum equivalency factor vs. zero g/mile tailpipe emissions) and proposed EV Multipliers in the GHG program are expected to become increasingly important. We have therefore added an analysis of these impacts to the historic precedent of accounting for differences in A/C credits. The assessment is based on NHTSA's CAFE Model Central Analysis of the proposed standards (Alternative 2) for standard-setting. Steps were taken to ensure values related to the EPA standards reflect the EPA NPRM instead of a mix of the 2020 SAFE Rule and California

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[56] Graphics by author based on data from 2010 Rule (*supra* note 44) at 25330 (Table I.B.2-1), 25331 (Table I.B.2-4), and 25372 (Table II.D-1) (model years 2012-2016); and 2020 SAFE Rule (*supra* note 28) at 24198 (Tables II-15 and II-16, and CAFE Model central analysis Scenarios input file (model years 2017-2025).

[57] Notwithstanding our comments in Appendix IV regarding NHTSA's inclusion of EVs in their analysis for standard setting, NHTSA's assessment provides a convenient public projection to inform an analysis of the differing compliance resulting from EV compliance calculations and proposed EV Multipliers. To the extent other sources vary in projections of U.S. EV market share, the estimated impacts will vary in the same direction.

Framework Agreements[58] as modeled by NHTSA. A description of the methodology is available in Attachment 1, "Description of Analysis for Assessment of CAFE to GHG Harmonization." The results of the analysis are shown in Figure III-3 using the same conventions as Figures III-1 and III-2, adding a gray area for differences in EV compliance calculations, and a gold area for differences resulting from the EPA-proposed EV Multipliers. In MY 2024, the proposed passenger car CAFE and GHG standards are roughly harmonized based on the factors quantified.[59] By MY 2025, the proposed passenger CAFE standards effectively become more stringent than the GHG standards after consideration of differences in EV compliance calculations and by MY 2026 the offset between the proposed CAFE and GHG standards is insufficient to cover even the NHTSA-estimated direct A/C emission credits.[60] In MY 2026, a passenger car fleet built to comply with the proposed GHG standards would be 7.0 g/mile (2.6 MPG) worse than target to the proposed CAFE standards. Similarly for the proposed light truck CAFE and GHG standards, there is rough harmonization in MY 2025, and by MY 2026 the proposed CAFE standards become more stringent than the proposed GHG standards. A light truck fleet built to comply with the proposed GHG standards would be 5.6 g/mile (1.1 MPG) worse than target to the proposed CAFE standards. Auto Innovators recommends that, at minimum, the differences caused by direct A/C emissions credits, EV compliance calculation differences, and EV Multipliers be accounted for when final CAFE and GHG standards are set for MYs 2025-2026.

[58] *Framework Agreements on Clean Cars*, California Air Resources Board, https://ww2.arb.ca.gov/resources/documents/framework-agreements-clean-cars (accessed Sep. 24, 2021). Hereinafter "*Framework Agreements*."

[59] Proposed MY 2024 light truck CAFE standard stringency is approximately 10 g/mile less stringent than the proposed MY 2024 GHG standard stringency, thus there is not a harmonization concern from the perspective of Auto Innovators. The difference is largely the result of NHTSA's revisions starting one year later. Auto Innovators opposes increasing the stringency of the proposed MY 2024 light truck CAFE standards given the economic practicability of the additional technology requirements that would result by MY 2024 and in the years preceding it. As noted elsewhere, there are also other unquantified differences that make the CAFE program relatively more stringent than the GHG program.

[60] We further note that NHTSA's estimate of the direct A/C emission credits may be low given recent passage of the American Innovation and Manufacturing (AIM) Act, EPA's regulations and grants of petitions related to the AIM Act, and CARB's stated intent to eliminate the use of high-global warming potential refrigerants in new light-duty vehicles, all of which will likely result in a phasedown of high-GWP refrigerants from use in light-duty vehicles (and a likely maximization of related credits) sooner rather than later.

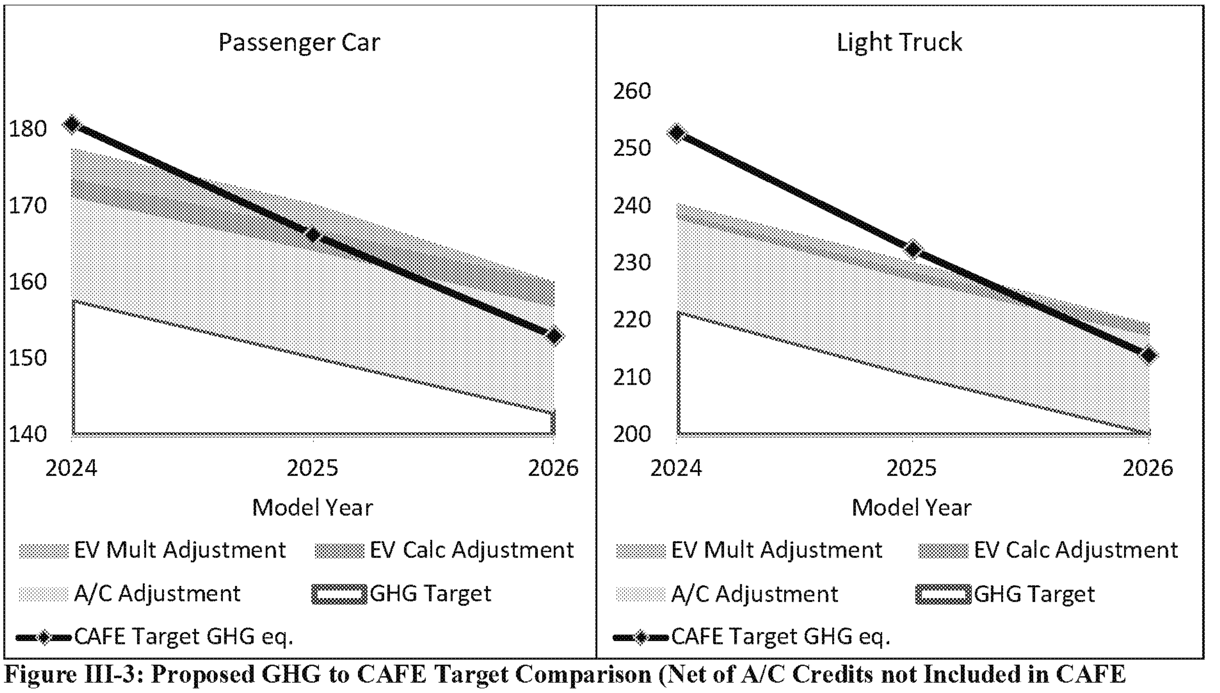

Figure III-3: Proposed GHG to CAFE Target Comparison (Net of A/C Credits not Included in CAFE Program, Electric Vehicle Compliance Calculation Differences and GHG Electric Vehicle Production Multipliers), MYs 2024-2026, Passenger Cars and Light Trucks[61]

Implications For the Future

Historically, the EPA and NHTSA standards have been offset numerically by approximately the level of A/C credits not included in the NHTSA CAFE program. As EVs become an increasingly important compliance pathway, their effects on harmonization, stemming from differing compliance treatment, will also become increasingly important. Given NHTSA's statutory constraints against the consideration of alternative fuels in setting maximum feasible standards, GHG and CAFE standards are likely to diverge further in the future. Addressing this issue is complex, and Auto Innovators believes that addressing it should be a joint effort between NHTSA and automobile manufacturers with input from other stakeholders. We recommend that NHTSA proactively engage with automobile manufacturers and Auto Innovators prior to any formal regulatory proposals.

[61] Graphics by author based on data from CAFE NPRM (*supra* note 2) CAFE Model Central Analysis, standard setting input and output files, as described in Attachment 1.

Appendix IV: NHTSA's Consideration of Electric Vehicles in Standard-Setting

NHTSA Has Improperly Considered Electric Vehicles in its Standard-Setting

In establishing its proposed alternative of a nominal eight percent increase in the annual stringency of fleetwide MY 2024-2026 CAFE standards ("Alternative 2"), it appears that NHTSA has improperly considered EVs in its standard-setting. The preamble to the CAFE NPRM indicates that NHTSA has included BEVs in the "baseline" used in selecting Alternative 2,[62] and the CAFE Model analysis for standard-setting both includes the alternative fuel benefits of EVs and adds EV sales in response to increasingly stringent standard alternatives. EV sales during the years covered by the regulations were modeled in the analysis supporting the standards. NHTSA's doing so violates important restrictions in the Energy Policy & Conservation Act, as amended by the Energy Independence and Security Act. We therefore request that NHTSA redo its standard-setting analyses to omit EVs and their benefits from the baseline and from its modeling. Auto Innovators believes that a standard-setting properly constructed in this way will yield regulations that appropriately incentivize EV technology, as intended by Congress.

<u>EPCA Prohibits NHTSA From Considering BEVs in its Determination of Maximum Feasible Fuel Economy Standards</u>

EPCA requires NHTSA to "prescribe by regulation average fuel economy standards for automobiles manufactured by a manufacturer in that model year,"[63] and in doing so the agency "shall consider technological feasibility, economic practicability, the effect of other motor vehicle standards of the Government on fuel economy, and the need of the United States to conserve energy."[64] EPCA, however, includes an important express limitation on what NHTSA may, and may not, take into account in determining what the "maximum feasible" fuel economy standard is:

> In carrying out subsections (c), (f), and (g) of this section, the Secretary of Transportation—
>
> (1) may not consider the fuel economy of dedicated automobiles;
>
> (2) shall consider dual fueled automobiles to be operated only on gasoline or diesel fuel; and

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[62] *See, e.g.*, CAFE NPRM (*supra* note 2) at 49602, 49622, 49640, and 49793.

[63] 49 U.S.C. § 32902(a).

[64] 49 U.S.C. § 32902(f).

> (3) may not consider, when prescribing a fuel economy standard, the trading, transferring, or availability of credits under section 32903.[65]

The term "dedicated automobile" is defined in EPCA as "an automobile that operates only on alternative fuel,"[66] and electricity is one such alternative fuel.[67] Similarly, the term "dual fueled automobile means "an automobile that – (A) is capable of operating on alternative fuel… and on gasoline or diesel fuel…"[68] Therefore, in promulgating fuel economy standards under EPCA, NHTSA is prohibited from "consider[ing]" the fuel economy of BEVs. Also, for dual fueled automobiles such as PHEVs, NHTSA is required to only consider their operation on gasoline or diesel fuel.

The statutory and legislative history of this provision demonstrates that its intent was to incentivize manufacturers to produce and sell dedicated and dual fueled alternative fuel vehicles by allowing them to be included in a manufacturer's compliance fleet while not being included in the standard-setting; the intended result is that automakers producing and selling such vehicles will have an easier time complying with the standards. This exclusion first appeared in the Alternative Motor Fuels Act of 1988 ("AMFA"), Pub. L. No. 100-494, but it was limited to methanol, which at the time was the dominant form of alternative fuel. The statute amended Section 502(e) of EPCA to provide that in determining maximum feasible fuel economy, "the Secretary shall not consider the fuel economy of alcohol powered automobiles or natural gas powered automobiles …" Pub. L. No. 100-494, § 6, 102 Stat. 2441, 2452 (1988). Representative John Dingell explained the intent of the amendment as follows:

> We … intend that the Secretary [of Transportation] shall not take into account the extent to which manufacturers have produced alternative fueled vehicles whenever the Secretary decides whether to amend the CAFE standard for cars or light trucks. … ***A provision is included in the legislation to ensure that the incentives provided by this bill are not erased by the Secretary's setting the CAFE standard for cars or trucks at a level that assumes a certain penetration of alternative fueled vehicles***. … It is intended that this examination [of maximum feasible fuel economy] will be conducted without regard to the penetration of alternative fuel vehicles in any manufacturer's fleet, in order to ensure that manufacturers taking advantage of the incentives offered by this bill do not find DOT including those incentive increases in the manufacturer's "maximum fuel economy capability.[69]

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[65] 49 U.S.C. § 32902(h).

[66] 49 U.S.C. § 32901(a)(8).

[67] 49 U.S.C. § 32901(a)(1)(J).

[68] 49 U.S.C. § 32901(a)(9).

[69] 134 Cong. Rec. H8091 (daily ed. Sept. 23, 1988) (***emphasis*** added).

This exclusion was subsequently expanded to include electric vehicles in the Energy Policy Act of 1992.[70] Again, the legislative history shows that Congress intended for the statute to incentivize investments in alternative fueled by excluding them from the calculation of a "maximum feasible" fuel economy standard given the uncertainties in the market:

> The widespread use for motor vehicles of fuels other than gasoline—such as methanol, ethanol, other alcohols, natural gas … and electricity—faces several problems. The current market price of gasoline is lower than the current market price of most alternative fuels. There must be major investments in new production plants for alternative fuels and in networks of stations for alternative fuels. There must also be major investments in new cars or engines or converting existing vehicles.[71]

NHTSA has consistently interpreted the exclusions currently found in 49 U.S.C. § 32902(h) as preventing the agency from accounting for BEVs in its standard-setting, either as part of the baseline or as part of the modeling that supports the final standards. For instance, during the Obama Administration, when setting MY 2011 CAFE standards, NHTSA explained the dedicated-automobile exclusion as follows:

> 49 U.S.C. § 32902(h) expressly prohibits NHTSA from considering the fuel economy of "dedicated" automobiles in setting CAFE standards. Dedicated automobiles are those that operate only on an alternative fuel, like all-electric or natural gas vehicles. Dedicated vehicles often achieve higher mile per gallon (or equivalent) ratings than regular gasoline vehicles, so this prohibition prevents NHTSA from raising CAFE standards by averaging these vehicles into our determination of a manufacturer's maximum feasible fuel economy level.[72]

NHTSA has also applied Section 32902(h) to its consideration of the "baseline" fleet. Another portion of Section 32902(h) prohibits NHTSA from considering the trading, transferring, or availability of credits under section 32903—the same as NHTSA is prohibited from considering BEVs.[73] In applying that constraint, NHTSA explained in its Light Truck Final Rule for MYs 2008-2011 that the statute "prohibits us" from taking account of the credits available for the sale of flex-fueled vehicles "in determining the maximum feasible fuel

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[70] *See* Pub. L. No. 102-486, § 403, 106 Stat. 2776, 2876 (amending EPCA section 502(e) to provide that "[f]or purposes of this section, the Secretary shall not consider the fuel economy of dedicated automobiles.").

[71] 5 H.R. Rep. No. 102-474, at 34 (1992). The current text of the dedicated-automobile exclusion, see supra p. 2, is a product of Pub. L. No. 103-272 (1994), which transferred EPCA from title 15 to title 49 "without substantive change." H.R. Rep. No. 103-130, at 1 (1994).

[72] 74 Fed. Reg. 14196, 14387 (Mar. 30, 2009) (footnote omitted).

[73] 49 U.S.C. § 32902(h)(3).

economy standard. ***Accordingly, the baseline projection cannot reflect those credits***."[74] Up until now, NHTSA's practice has been faithful to the text and the intent of the exclusions in Section 32902(h) by excluding BEVs and the other prohibited considerations from its baseline and its analyses setting fuel economy standards.

NHTSA Has Improperly Considered Sales of BEVs and PHEVs in its Determination of Maximum Feasible Fuel Economy Standards

In the current rulemaking, NHTSA has considered EVs in two ways that conflict with the text and intent of EPCA and that are inconsistent with past practice.

First, the NPRM makes it clear that NHTSA is accounting for BEVs in what it calls its "baseline" or "No-Action alternative" and in other action alternatives for its standard-setting analysis.[75] NHTSA also explains how EVs are included in all regulatory alternatives in its Technical Support Document ("TSD").[76] The TSD goes on to explain how NHTSA built ZEV Mandate compliance into its modeling by "converting vehicles that have been identified as potential ZEV candidates into battery-electric vehicles (BEVs) at the first redesign opportunity, so that a manufacturer's fleet meets calculated ZEV credit requirements."[77] It is therefore clear that NHTSA's compliance modeling, which undergirds its entire standard-setting analysis, considers the fuel economy of BEVs the agency projects will be produced and sold to comply with the ZEV Mandate.

The extent to which BEVs and PHEVs are included in the analysis of the baseline fleet (Alternative 0) and in the other alternatives considered in the proposal is demonstrated in Figures IV-1 and IV-2. In the NHTSA standard-setting analysis, BEV market share grows from less than two percent in MY 2020 to almost five percent by MY 2026 in the baseline fleet (Alternative 0). In Alternative 2, the proposed standards, BEV market share increases to over six percent by 2026. Despite their exclusion from NHTSA's evaluation of ZEV Mandate compliance, PHEV market share grows from less than one percent in MY 2020 to almost two

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[74] 71 Fed. Reg. 17566, 17582 (Apr. 6, 2006) (citing 49 U.S.C. § 32902(h)) (***emphasis*** added), remanded on other grounds by *Center for Biological Diversity v. NHTSA*, 538 F.3d 1172, (9th Cir. 2008).

[75] See 86 Fed. Reg. at 49793 ("NHTSA has considered and accounted for California's ZEV mandate (and its adoption by the other [sic] Section 177 states) in developing the baseline for this proposal."); *id.* at 49622 ("NHTSA believes that it is reasonable to include ZEV in the baseline for this proposal regardless of whether California receives a waiver of preemption under the Clean Air Act (CAA) …"); *id.* at 49749 ("As the baseline against which the Action Alternatives are measured, the No-Action Alternative also includes several other actions that NHTSA believes will occur in the absence of further regulatory action… NHTSA has included California's ZEV mandate as part of the No-Action Alternative.")

[76] *See CAFE TSD* (*supra* note 18) at 39. ("All of the regulatory alternatives considered here also include NHTSA's estimates of ways each manufacturer could introduce new PHEVs and BEVs in response to ZEV mandates.")

[77] *Id.* at 104. *See also id.* at 109 ("Third, we assume that manufacturers will meet their ZEV credit requirements in 2025 though the production of battery electric vehicles (BEVs).")

percent in MY 2026 under Alternative 0 and to about seven percent under Alternative 2. The combined BEV and PHEV market share grows from a little over two percent in MY 2020 to over six percent and 14 percent in MY 2026 for Alternatives 0 and 2, respectively (Figure IV-3).

NHTSA has also considered the alternative fuel operation of dual fueled vehicles (specifically plug-in hybrids) in violation of Section 32902(h)(2). The Vehicles Report output file makes it clear that the compliance fuel economy used by the model (the "FE Compliance" field) includes the alternative fuel portion of vehicle operation for PHEVs. For the purposes of the standard-setting analysis, NHTSA should only consider the fuel economy of a PHEV when operating on conventional fuel. For example, the technology effectiveness database could include one value reflective of gasoline-powered hybrid operation, and another value, not used for standard-setting, that reflects combined gasoline and off-board electricity-powered operation.

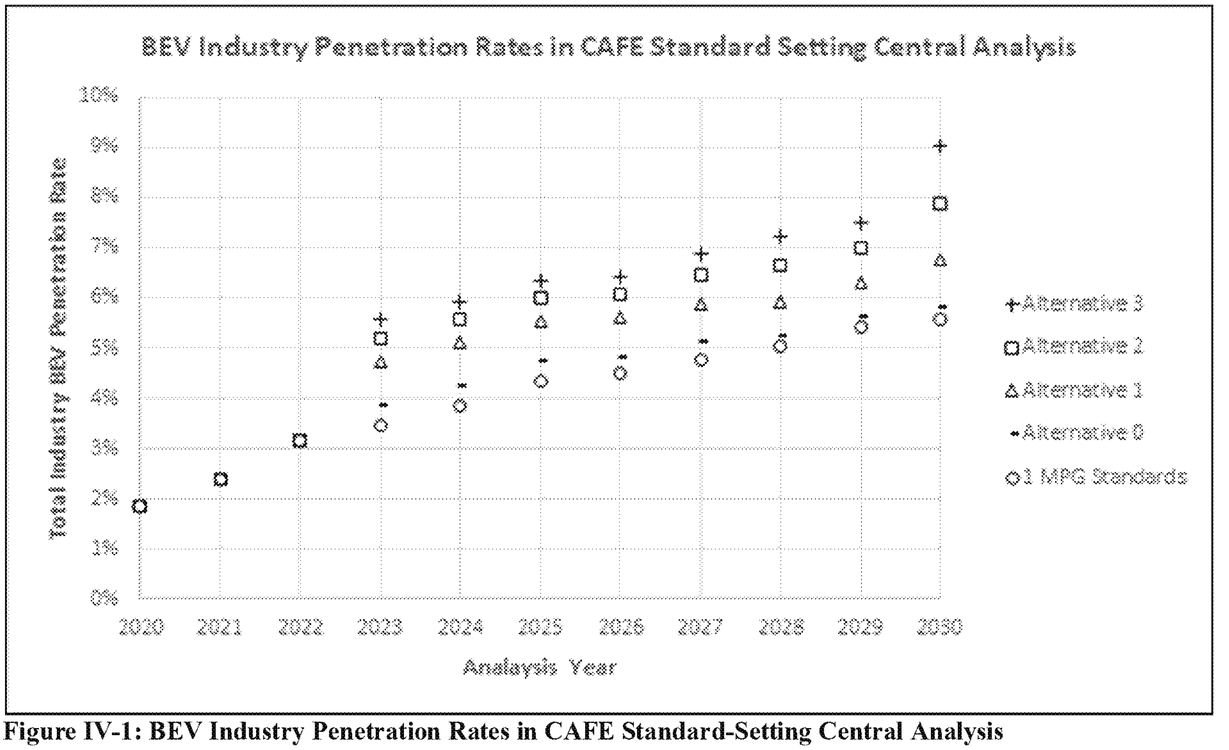

Figure IV-1: BEV Industry Penetration Rates in CAFE Standard-Setting Central Analysis

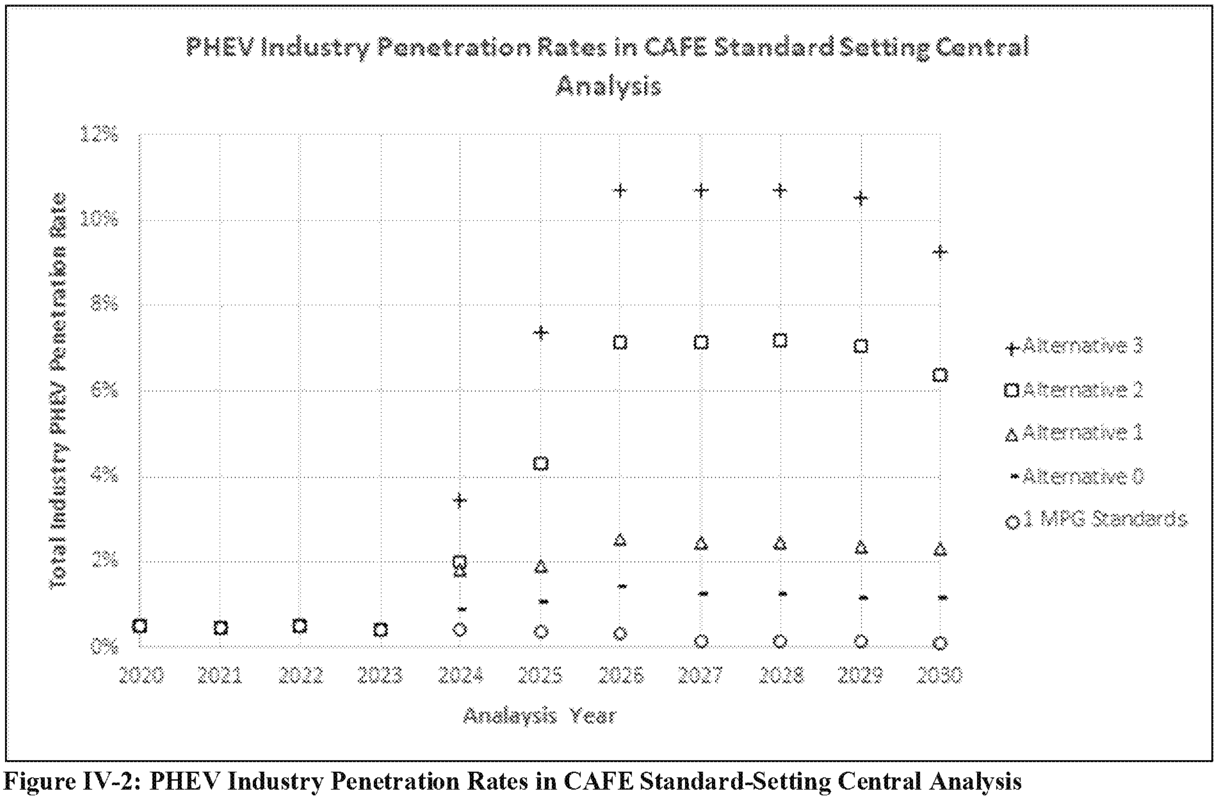

Figure IV-2: PHEV Industry Penetration Rates in CAFE Standard-Setting Central Analysis

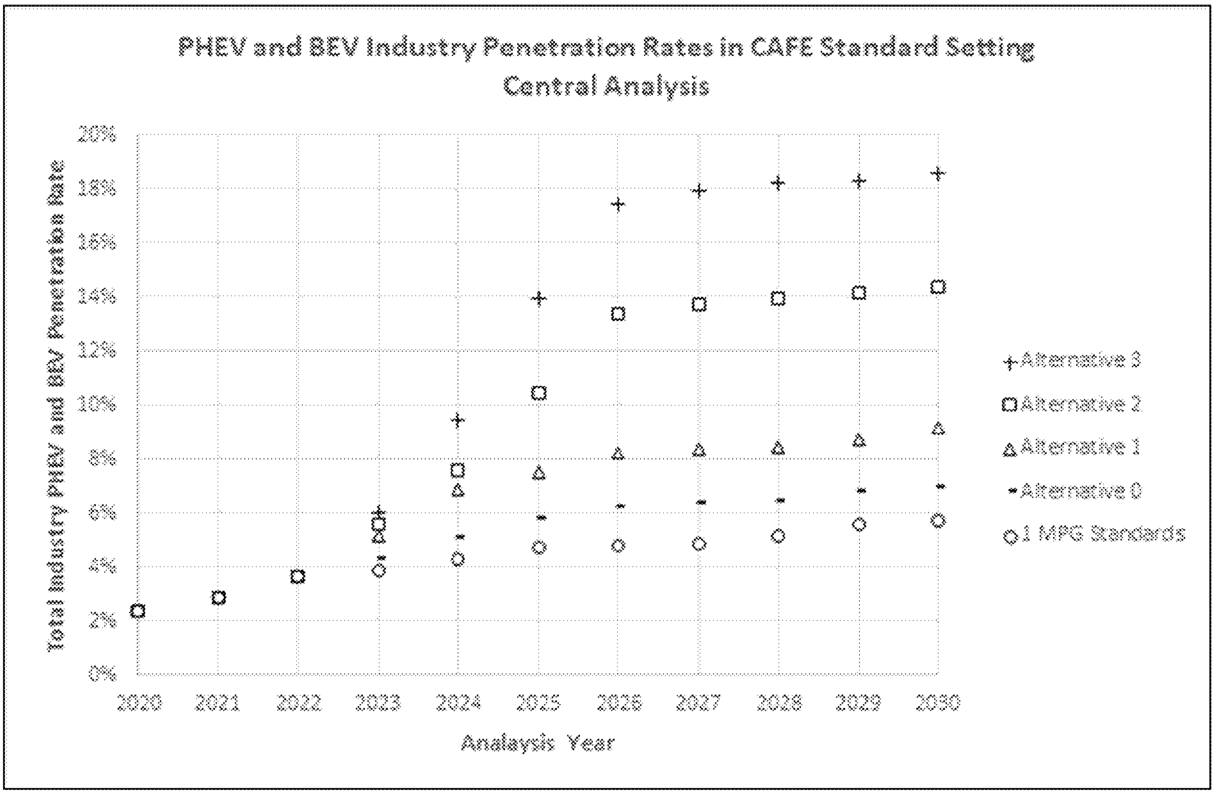

Figure IV-3: Combined PHEV and BEV Industry Penetration Rates in CAFE Standard-Setting Central Analysis

It is therefore clear that the penetration of EVs in the light vehicle market *and their fuel economy* are important factors in the agency's standard-setting here. NHTSA's proposed determination that the steep fuel economy curves set forth in Alternative 2 are technologically feasible and economically practicable is based on (a) the high penetration of EVs in the light-duty fleet during the covered years (MYs 2024-2026) to account for the ZEV mandate, and (b) the high imputed fuel economy values attributed to those EVs. If, hypothetically, EVs were to have fuel economy values of (say) 15 mpg, then it would be impossible to support the current proposal.

NHTSA appears to be relying, in part, on the "other motor vehicle standards of the government" prong of 49 U.S.C. § 32902(f) to justify its consideration of BEVs in its standard-setting.[78] This justification is unavailing for two separate and independent reasons.

First, it violates the well-established canon of statutory construction *generalia specialibus non derogant*—that is: if there is a conflict between a general provision and a

[78] *See,* CAFE NPRM (*supra* note 2) at 49639 ("[W]hen considering other standards that may affect fuel economy compliance pathways, DOT includes projected zero emissions vehicles (ZEV) that would be required for manufacturers to meet standards in California and Section 177 States, per the waiver granted under the Clean Air Act.").

specific provision in a statute, the specific provision prevails.[79] This is especially true where "the two are interrelated and closely positioned, both in fact being parts of [the same statutory scheme]."[80] Here, there is specific and express prohibition against NHTSA considering dedicated alternative fuel vehicles and the operation of dual-fueled vehicles on alternative fuels in its standard-setting, and those prohibitions trump the more general provision requiring NHTSA to consider other motor vehicle standards of the government.

Second, NHTSA's reliance on that section of EPCA would thwart Congress's intent in expanding the alternative fuel exclusion in Section 502(e) to cover EVs. The Energy Policy Act of 1992 was enacted against the backdrop of California's promulgation of ZEV regulations. Congress amended EPCA to include BEVs (among other "dedicated automobiles") in order to prevent NHTSA from including compliance with those regulations in its standard-setting calculations—precisely what NHTSA purports to do here. Congress did so because then—as today—electric vehicles faced significant market uncertainty.[81]

NHTSA also inappropriately allows the CAFE Model standard-setting analysis to add BEVs and PHEVs in response to the No-Action and action alternatives considered. Although the CAFE Model is constrained from applying BEV or FCEV technology in the specific standard-setting years (other than that added to the baseline in response to the ZEV Mandate, as discussed above), PHEV technology does not appear so constrained.[82,83] Moreover, as a result of the CAFE Model's multiyear planning feature, under which technology can be added in advance of standard-setting years in response to the following years' simulated standards,

[79] *See RadLAX Gateway Hotel, LLC v. Amalgamated Bank*, 566 U.S. 639, 645 (2012) ("it is a commonplace of statutory construction that the specific governs the general.").

[80] *HCSC-Laundry v. United States*, 450 U.S. 1, 6 (1981) (per curiam).

[81] *See* H.R. Rep. No. 102-217, pt. 1, at 12 (1991) ("[T]he American public must be sold not only on the environmental value of EV's, but also on their practical transport, safety and economic value. … Other barriers above and beyond technology and cost considerations that will affect the commercialization of electric vehicles include the lack of a current infrastructure …").

[82] *Draft CAFE Model Documentation*, National Highway Traffic Safety Administration (Aug. 2021) at 33. ("Each regulatory scenario definition includes a Standard Setting Year field, which specifies whether new standards are being set during a given year. Technologies that convert a vehicle to a battery-electric or a fuel-cell vehicle (e.g., BEV200 or FCV) will be further restricted from application during these "standard setting" years. If, however, the vehicle in question is designated as a "ZEV Candidate" by the user in the market data inputs, this restriction will not apply.")

[83] In itself, model selection of PHEVs is not a violation of 49 U.S.C. § 32902(h)(2). However, if the electric portion of their operation is included in their consideration, NHTSA would be in violation of the statute. This appears to be the case. The Vehicles Report output file indicates the compliance fuel economy used by the model for various vehicles ("FE Compliance," column AH). In the Central Analysis standard-setting reference case (output file folder M000000_P0000000_S000000_T00000_3), Alternative 2 (the proposal) has compliance fuel economy for PHEVs equal to the harmonic average of their projected fuel economy on gasoline and that on electricity, an alternative fuel.

significant additional BEVs are added in model year 2023 (Figure IV-1) and additional PHEVs are added during the standard-setting years (Figure IV-2), with their electrical portion of operation considered in their compliance fuel economy, as noted above. NHTSA describes, "Changes are shown to occur in MY 2023 even though NHTSA is not explicitly proposing to regulate that model year because NHTSA anticipates that manufacturers could make changes as early as that model year to affect future compliance position (*i.e.*, multi-year planning)."[84] In the same vein, the multiyear planning function also allows the addition of technology after the standard-setting years, "as some manufacturers and products 'catch up' to the standards."[85] Notwithstanding our concerns with including the ZEV mandate in the baseline (Alternative 0), additional EV volume added in response to the simulated standards (and considering the portion of operation on electricity) is another clear violation of 49 U.S.C. § 32902(h) whether the EVs are added in advance of or after the standard-setting years.

In order to be faithful to both the text and the intent of Section 32902(h), NHTSA must completely exclude the sale of BEVs and the electric portion of the operation of PHEVs from its standard-setting analyses, unless and until Congress modifies the prohibitions against their inclusion in setting maximum feasible standards.

Comments on NHTSA's Proposal to Consider Electrification as a Vehicle Attribute

Choice of Footprint as the Attribute on Which the Proposed Standards Are Based

NHTSA seeks information on the choice of footprint as the attribute on which the proposed standards are based, and in particular regarding the 2021 NAS recommendation to consider electrification as an additional attribute to determine standard targets.[86] Auto Innovators concurs with NHTSA that the changes in the market since 2018 and previously reinforce the appropriateness of vehicle footprint as the sole attribute basis for the passenger car and light truck standards. The footprint-indexed standards continue to serve the intended objectives of deploying efficiency and CO_2-reduction technology in the market across all companies and all market segments, while allowing some fluctuation due to natural market trends. As indicated in the EPA Trends Report, the change in industry average vehicle footprint has been minimal: Within vehicle segments, the vehicle footprint change has ranged from a 0.3% increase in car-based sport utility vehicles, up to 3.3% in pickups, since footprint-indexed standards were first implemented in 2008 through 2019.[87] Based on the most recent data trends across manufacturers over 2018 through preliminary data for 2020, industry-wide changes are

[84] CAFE NPRM (*supra* note 2) at 49757.

[85] *Id.* at 49620.

[86] CAFE NPRM (*supra* note 2) at 49361.

[87] *EPA Trends Report* (*supra* note 47) at 26 and Figure 3.12.

expected to have no change in average vehicle footprint.[88] These data show that the footprint-indexed standards are functioning as intended, allowing market changes across companies and segments, without encouraging a major shift in vehicle footprint.

NHTSA's Proposal to Consider Electrification as an Attribute

In the TSD, NHTSA sets forth a proposal to develop a three-dimensional attribute function that accounts for both a vehicle's footprint and degree of electrification.[89] Importantly, the proposal would assess "electrification" broadly to include any electrified component that can be integrated into a vehicle to shift some of the mechanical work away from burning fuel. This would include mild hybrids, conventional hybrids and plug-in hybrids.

Auto Innovators does not support NHTSA pursuing this proposal because the current two-dimensional footprint-based standards already account for vehicle electrification to the greatest extent allowable under EPCA. This is demonstrated by a closer look at the various steps NHTSA has outlined on pages 24 and 25 of the TSD. Under its proposal, Step 1 would be:

> Define a 3-dimensional function relating mpg (or gpm) to footprint and degree of electrification based on current vehicle data and simulation modeling of technologically feasible vehicle designs. This would include everything from integrated starter-generators to very long-range PHEVs but need not include dedicated automobiles such as BEVs and FCEVs. In this phase, there is no need to consider the cost of electrification.[90]

At this step, NHTSA seems to recognize that inclusion of BEVs would run afoul of the restriction in 49 U.S.C. § 32902(h)(1) against considering the fuel economy of dedicated automobiles like BEVs. However, even NHTSA's inclusion of PHEVs is problematic, because 49 U.S.C. § 32902(h)(2) states that in setting fuel economy standards, NHTSA "shall consider dual fueled automobiles to be operated only on gasoline or diesel fuel." The attribute-based curve is foundational to the standard-setting, and EPCA is clear that to the extent that NHTSA is considering PHEVs in setting CAFE standards, it must assume that they are running completely on gasoline or diesel. That is inconsistent with the attribute-based analysis NHTSA has proposed in the TSD, in which the contribution of the electric drive to reducing fuel consumption is considered.

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[88] *EPA Trends Report* (*supra* note 47) at 34. Despite a shift from passenger cars to light trucks, the preliminary 2020 data shows a reduction in light truck footprint by 1.5% offsets a 0.6% increase in passenger car footprint since 2018.

[89] *CAFE TSD* (*supra* note 18) at 23 *et seq*.

[90] *Ibid.*

The next problem arises when NHTSA builds consideration of BEVs into the analysis in Steps 2 and 3. First, in Step 2, NHTSA would "[c]hoose a set of levels of electrification by model year consistent with policy goals to test for economic practicability," and then Step 3 would "[e]valuate the cost-effectiveness of achieving the different levels of electrification," *including* dedicated vehicles like BEVs.[91] BEVs would be included "because they are a potentially cost-effective way for OEMs to achieve electrification." NHTSA believes that this approach would be permissible because, in the agency's view, "[t]he fuel economy of dedicated automobiles is not be [sic] considered, but only their cost and contribution to meeting the level of electrification consistent with policy goals."[92]

The problem with NHTSA's purported justification is it ignores the fact that this entire exercise is aimed at setting CAFE standards, as expressed through this new 3-D attribute approach. The contribution of BEVs to electrification is just a link in the chain that leads back to the "economic practicability" of the CAFE standards. In other words, Step 2 is aimed at determining what levels of electrification in the light duty fleet would still satisfy the "economic practicability" prong of 42 U.S.C. § 32902(f), and Step 3 would assess the extent to which BEVs would be a cost-effective way of achieving that level of electrification. But the bottom line continues to be the extent to which BEVs are a cost-effective means of complying with the CAFE standards, and in order to make that assessment one must "consider the fuel economy" of these vehicles. This can be further demonstrated by positing a counter hypothetical in which BEVs achieve very low levels of fuel economy for compliance purposes. If that were the case, then NHTSA's analysis in the TSD would fall apart: BEVs would *not* be "a cost-effective way for OEMs to achieve electrification," and that would then reduce the level of electrification that could support economically practical CAFE standards. Because the analysis in the TSD is dependent on the high fuel economy attributed to BEVs, it is clear that NHTSA's proposal would improperly "consider[] the fuel economy of dedicated automobiles.[93]

NHTSA recognizes the legal pitfall posed by attempting to craft such a standard-setting framework while avoiding 49 U.S.C. 32902(h):

> The method also depends on the legality of allowing dedicated automobiles' potentially cost-effective contributions to electrification, not their fuel economy per se, to be considered in determining the economic practicability of the standards. Put another way, is it within the limitations of the statute to demonstrate the economic practicability of a fuel economy footprint function by showing that the degree of electrification that could accomplish the levels of fuel economy it requires is economically practicable?[94]

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[91] *Ibid.*

[92] *Ibid.*

[93] 49 U.S.C. § 32902(h)(1).

[94] *CAFE TSD* (*supra* note 18) at 27.

NHTSA does not answer this question in the TSD, presumably because an answer is not readily apparent. As discussed above, it is impossible to consider the contribution of a BEV to compliance with a fuel economy standard without considering that vehicle's fuel economy.

Stripping away the consideration of BEVs takes one back to the other justification posited by NHTSA: "The legitimacy of the proposed method depends on the fact that establishing a relationship between electrification and fuel economy need not include dedicated automobiles."[95] Thus, as NHTSA points out, "HEVs are partially electrified yet 100% of their energy comes from gasoline (actually E10)."[96] Strong hybrids and lower levels of electrification are simply efficiency improvers for gasoline operation. Auto Innovators agrees that limiting the consideration of electrification to just HEVs would avoid the legal prohibitions set forth in 49 U.S.C. § 32909(h)(1) concerning BEVs, and (h)(2) concerning PHEVs. But there is no need to construct a new 3-D attribute system to do so. The existing approach with footprint-based curves does not need to be modified if one simply wants to require a more efficient gasoline-powered fleet—whether through increased electrification or some other means.

Potential Unintended Consequences of Adopting Vehicle Electrification as an Attribute

In addition, as we describe thoroughly in Appendix VII, Auto Innovators believes NHTSA should more carefully consider the supply chain for batteries and related components. Although U.S. battery manufacturing facilities are under development by several automobile manufacturers and suppliers, the industry is still highly reliant on imports of processed raw materials and other critical components. NHTSA itself recognizes some of these issues in describing foreign policy considerations associated with battery supply chains.[97] Insofar as one of the purposes of the CAFE program is to reduce imported energy, absent a comprehensive and sustained strategy to foster and support the EV supply chain (including mineral extraction, processing, and battery cell manufacturing/recycling), including electrification as a fuel economy attribute could be solidifying a dependence on foreign supply chains that might not be reliable or have shared interests with our country.

[95] *Ibid.*

[96] *Ibid.*

[97] CAFE NPRM (*supra* note 2) at 49796. ("Because lithium-ion battery materials have a wide global diversity of origin, accessing them can pose varying geopolitical challenges.")

Appendix V: The Proposed Standards and Other Standard-Setting Considerations

Context of These Comments

Auto Innovators generally supports the proposed revised EPA standards for MYs 2023-2026, with appropriate flexibilities. We provide the following comments to NHTSA to demonstrate that Alternative 2 may be beyond the maximum feasible level, given further consideration of economic practicability. Thus, harmonization with the proposed EPA standards could be appropriate for this rulemaking. These comments also support NHTSA's finding that Alternative 3 is beyond the maximum feasible level of standards for MYs 2024-2026.[98] Finally, we briefly address NHTSA's request for comment regarding minimum domestic passenger car standards.

Considerations for Economic Practicability

Payback Period for Alternatives 2 and 3

Alternative 2, and Alternative 3 compliance pathways project that a significant portion of the fleet will adopt fuel-saving technologies that take a very long time to pay back for consumers, in response to proposed regulations. Among many outputs, the CAFE Model reports the projected payback period to consumers for additional fuel saving technologies as applied to individual vehicles. This information is presented in column "CG" of the Vehicles Report, for all alternatives, and given all input assumptions about technology costs, and fuel prices.

The following table summarizes the agency's projected payback for total cost of ownership ("Payback TCO") for 2026 vehicles, by ranges of footprint (FP), by Alternative, by fuel price forecast.[99]

[98] CAFE NPRM (*supra* note 2) at 49810 *et seq*. ("Alternative 3 may be too costly to be economically practicable in the rulemaking timeframe… with negative net benefits for Alternative 3 under both discount rates, it may be that for the moment, the costs of achieving those benefits are more than the market is willing to bear… NHTSA therefore proposes that Alternative 2 is maximum feasible for MYs 2024-2026.")

[99] The table presents Central Case results as well as results with the Global Insight fuel price forecast (available in the sensitivity cases).

Table V-1: Payback Period for Modeled MY 2026 Vehicles by Footprint, Alternative, and Fuel Price Forecast

		Percentage of 2026 projected sales, and reported Payback Years in Total Cost of Ownership											
		Payback TCO (years), Central Case Fuel Forecast						Payback TCO (years), Global Insight Fuel Forecast					
		0-3	4-7	8-11	12-15	16+	Row Sum	0-3	4-7	8-11	12-15	16+	Row Sum
Alternative0	FP <= 43 sqft.	1.6%	3.6%	0.1%	0.0%	0.2%	5.5%	1.6%	3.6%	0.1%	0.0%	0.2%	5.5%
	43 sqft < FP <= 47 sqft.	16.1%	15.6%	2.3%	0.6%	0.8%	35.4%	15.6%	15.5%	2.5%	0.4%	1.4%	35.4%
	47 sqft < FP <= 51 sqft.	10.0%	13.4%	1.8%	0.3%	0.9%	26.3%	10.0%	12.7%	2.5%	0.2%	1.0%	26.4%
	51 sqft < FP <= 55 sqft.	4.0%	7.4%	0.6%	0.1%	0.5%	12.7%	4.0%	6.9%	1.2%	0.0%	0.6%	12.7%
	55 sqft < FP <= 59 sqft.	4.8%	3.6%	0.6%	0.0%	0.0%	8.9%	4.7%	3.7%	0.4%	0.0%	0.0%	8.9%
	59 sqft < FP	2.6%	8.0%	0.4%	0.0%	0.1%	11.2%	2.6%	8.0%	0.4%	0.0%	0.1%	11.2%
	Column Sum	39.1%	51.5%	5.8%	1.1%	2.5%	100.0%	38.6%	50.3%	7.3%	0.6%	3.2%	100.0%
Alternative2	FP <= 43 sqft.	1.3%	3.0%	0.3%	0.2%	0.7%	5.4%	1.3%	3.0%	0.2%	0.2%	0.7%	5.4%
	43 sqft < FP <= 47 sqft.	6.2%	21.5%	3.4%	1.3%	2.9%	35.3%	6.2%	20.5%	4.0%	1.4%	3.2%	35.3%
	47 sqft < FP <= 51 sqft.	3.0%	15.1%	4.4%	0.4%	3.2%	26.0%	3.0%	13.9%	4.3%	1.4%	3.4%	26.0%
	51 sqft < FP <= 55 sqft.	3.3%	5.2%	2.0%	0.6%	1.7%	12.8%	3.3%	5.3%	2.3%	0.4%	1.9%	12.8%
	55 sqft < FP <= 59 sqft.	1.2%	5.3%	1.4%	0.2%	1.0%	9.1%	1.2%	5.2%	0.8%	0.6%	1.2%	9.1%
	59 sqft < FP	3.4%	4.1%	0.6%	0.3%	3.0%	11.4%	3.0%	4.4%	0.8%	0.0%	3.3%	11.4%
	Column Sum	18.5%	54.1%	12.0%	3.0%	12.4%	100.0%	17.8%	52.3%	[illegible]	4.1%	[illegible]	100.0%
Alternative3	FP <= 43 sqft.	0.6%	2.9%	0.8%	0.0%	1.1%	5.4%	0.6%	2.3%	1.4%	0.0%	1.1%	5.4%
	43 sqft < FP <= 47 sqft.	4.0%	18.7%	6.3%	1.5%	4.8%	35.3%	4.0%	18.6%	5.8%	1.3%	5.7%	35.3%
	47 sqft < FP <= 51 sqft.	1.8%	12.6%	4.8%	2.3%	4.3%	25.8%	1.8%	10.2%	5.5%	3.2%	5.1%	25.8%
	51 sqft < FP <= 55 sqft.	1.4%	5.6%	3.3%	0.4%	2.2%	12.9%	1.4%	5.5%	3.3%	0.3%	2.4%	12.9%
	55 sqft < FP <= 59 sqft.	1.0%	5.2%	0.5%	0.7%	1.8%	9.1%	0.9%	5.2%	0.5%	0.3%	2.1%	9.1%
	59 sqft < FP	2.9%	3.2%	1.5%	0.7%	3.0%	11.3%	2.9%	3.2%	1.5%	0.0%	3.8%	11.3%
	Column Sum	11.7%	48.4%	[illegible]	5.7%	[illegible]	100.0%	11.6%	45.0%	[illegible]	3.1%	[illegible]	100.0%

As part of the compliance pathways, the CAFE Model considers the application of many types of fuel-saving technologies, to many vehicles, at various points in time. For stringent alternatives, the CAFE Model is more likely to project the adoption of very expensive fuel-saving technologies (PHEVs, for instance), in order for manufacturers to comply with standards. The agency analysis projects that these types of technologies often take quite a long time to pay back, and sometimes the additional cost of fuel-saving technologies is never fully recouped.

The Central Case NHTSA analysis forecasts that, for Alternative 2, 27.4% of MY 2026 vehicles adopt fuel-saving technologies that take 8 or more years to pay back, and nearly 1 in 8 vehicles adopts technology that will not pay back for 16 or more years (if at all). For Alternative 3, with the Global Insight fuel price projections, 1 in 4 vehicles will take at least 12 years to pay back the cost of fuel-saving technologies, and over 40% of the fleet will include fuel-saving technologies that do not return investment until at least the 8th year of ownership and use. For Alternative 3, with the Global Insight fuel price forecast, 1 in 5 vehicles built in MY 2026 includes technology that will not pay back in the first 15 years of ownership and operation. If consumers are reluctant to adopt these technologies, the policy objectives of the higher stringency alternatives may not be fully realized.

Lead-Time for Technology Application

NHTSA notes that,

> …Regulatory alternatives that require extensive application of very advanced technologies (that may have known or unknown consumer acceptance issues) or that require manufacturers to apply additional technology in earlier model years, in which

meeting the standards is already challenging, may not be economically practicable, and may thus be beyond maximum feasible.[100]

As modeled by NHTSA, Alternative 2, and particularly Alternative 3, demonstrate that significant increases in technology levels are necessary in advance of or in the first year of the revised standards. NHTSA's Tables VI-7 and VI-8 (duplicated here as Figures V-1 and V-2) summarize some of the advanced technologies which will need to be rapidly implemented under these regulatory alternatives. For passenger cars, Alternative 2 (the proposal) is modeled as requiring an increase in advanced engines, strong hybrids, and EVs from ~20% of the market in 2020 to 62% of the market by MY 2024. In addition, advanced aerodynamic features on passenger cars are increased from eight percent in MY 2020 to 71% in MY 2024, and significant mass reduction increases from five percent to 28% of vehicles sold. For light trucks, advanced engines, hybrids, and EVs increase from 17% in MY 2020 to 48% in MY 2024 under Alternative 2. The increase in technologies required under Alternative 3 are even greater.

Table VI-7 – Estimated Market Share (%) of Selected Technologies, Passenger Cars, Alternative 2 and Alternative 3, Standard Setting Analysis

Tech	Alt	2020	2023	2024	2025	2026
PHEV (all types)	2	< 1	< 1	2	5	8
BEV (all ranges)	2	4	9	9	10	10
Advanced AERO[1]	2	8	48	71	82	87
Strong Hybrid (all types)	2	3	3	5	5	6
MR4[2]	2	5	12	28	36	44
Advanced Engine[3]	2	13	29	46	50	50
PHEV (all types)	3	< 1	< 1	2	7	10
BEV (all ranges)	3	4	9	10	10	10
Advanced AERO	3	8	48	76	87	92
Strong Hybrid (all types)	3	3	4	7	8	8
MR4	3	5	12	30	38	46
Advanced Engine	3	13	29	46	51	52

[1] Combined penetration of 15% and 20% aerodynamic improvement

[2] Reduce glider weight by 15%

[3] Combined penetration of advanced cylinder deactivation, advanced turbo, variable compression ratio, high compression ratio and diesel engines

Figure V-1: CAFE NPRM Table VI-7

[100] CAFE NPRM (*supra* note 2) at 49804.

Table VI-8 – Estimated Market Share (%) of Selected Technologies, Light Trucks, Alternative 2 and Alternative 3, Standard Setting Analysis

Tech	Alt	2020	2023	2024	2025	2026
PHEV (all types)	2	< 1	< 1	2	4	7
BEV (all ranges)	2	< 1	2	2	2	3
Advanced AERO[1]	2	16	38	55	64	75
Strong Hybrid (all types)	2	2	4	7	9	9
MR4[2]	2	11	12	16	21	28
Advanced Engine[3]	2	15	32	37	42	50
PHEV (all types)	3	< 1	< 1	4	8	12
BEV (all ranges)	3	< 1	2	2	3	3
Advanced AERO	3	16	38	55	64	74
Strong Hybrid (all types)	3	2	5	9	9	9
MR4	3	11	12	16	21	29
Advanced Engine	3	15	32	36	40	51

[1] Combined penetration of 15% and 20% aerodynamic improvement
[2] Reduce glider weight by 15%
[3] Combined penetration of advanced cylinder deactivation, advanced turbo, variable compression ratio, high compression ratio and diesel engines

Figure V-2: CAFE NPRM Table VI-8

While manufacturers have certainly not been idle in MYs 2021 and 2022, it is doubtful that such lofty technology penetrations will be achieved by MY 2023. Model year 2023 can start as early as January 2022 (about two months from now) and for most vehicle models will begin in less than a year.

NHTSA describes this very issue in its analysis of the economic practicability of the proposed alternative:

> The first issue is timing of technology application. While the MY 2024 standards provide less lead time for an increase in stringency than was provided by the standards set in 2012, NHTSA believes that the standards for MYs 2021–2023 should provide a relative ''break'' for compliance purposes. NHTSA does not believe that significant additional technology application would be required by the CAFE standards in the years immediately preceding the rulemaking time frame.[101]

Auto Innovators agrees that a 1.5 percent per year rate of stringency increase in MYs 2021-2023 is certainly less than the augural CAFE standards which required significantly faster improvements, but we disagree that MYs 2021-2023 are a "relative break for compliance

[101] *Ibid.*

purposes."[102] NHTSA's own modeling makes it clear that an eight percent per year stringency increase starting in MY 2024 will require major improvements before even MY 2024 given vehicle redesign schedules. While NHTSA may technically be providing the statutorily required 18-month lead-time for increasing standards,[103] the actual lead-time to achieve the improvements modeled by NHTSA is much less.

Minimum Domestic Passenger Car Standards

NHTSA is required to set minimum domestic passenger car standards ("MDPCSs") when it prescribes fuel economy standards.[104] NHTSA sets these standards as the greater of 27.5 mpg or 92% of the projected standard.[105] As noted by NHTSA, differences in fleet mix between that projected and that actually built can result in more stringent MDPCSs than anticipated.[106] In the 2020 SAFE Rule, NHTSA addressed this issue by adjusting the projected passenger car fleet standard by 1.9% lower, based on the average error from prior projections.[107] NHTSA proposes to continue this approach and requests comment on an alternative approach.[108] Auto Innovators supports NHTSA's use of the 1.9% downward adjustment in projected fuel economy standards based on historical differences between projected and actual CAFE passenger car standards. Although projecting future trends is uncertain, average footprints in the passenger car fleet have been increasing over the past decade as the U.S.

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[102] *Ibid.* (internal quotes removed).

[103] Assuming NHTSA finalizes its proposal by April 2022 and given NHTSA's historical interpretation of the start of a model year.

[104] 49 U.S.C. § 32902(b)(4).

[105] CAFE NPRM (*supra* note 2) at 49789. (Table VI-1 – Calculation of the Projected Total Passenger Car Fleet Standard and the Minimum Domestic Passenger Car Standard (92 Percent of the Total Passenger Car Standard) for the Preferred Alternative.)

[106] *Ibid.* ("…By assuming a smaller-footprint fleet, on average, than what ended up being produced, the MYs 2011–2018 MDPCS ended up being more stringent and placing a greater burden on manufacturers of domestic passenger cars than was projected and expected at the time of the rulemakings that established those standards.")

[107] *Ibid.* ("Therefore, in the 2020 final rule, to help avoid similar outcomes in the 2021–2026 timeframe to what had happened with the MDPCS over the preceding model years, NHTSA determined that it was reasonable and appropriate to consider the recent projection errors as part of estimating the total passenger car fleet fuel economy for MYs 2021–2026. NHTSA therefor projected the total passenger car fleet fuel economy using the central analysis value in each model year, and applied an offset based on the historical 1.9 percent difference identified for MYs 2011–2018.")

[108] *Ibid. et seq.*

market shifts away from smaller passenger cars toward utility vehicles classified as cars.[109,110] Despite this trend, NHTSA's modeling projects the average passenger car footprint to stay constant at 46.6 square feet in MYs 2020-2026.[111] While the development of a more sophisticated consumer choice model in the future might be better able to project trends in overall passenger car size (net of market shifts), such a model is likely beyond the scope of this rulemaking given the lead-time constraints to MY 2024. Given the contrast between the historical and projected footprint trend, making a small adjustment for this rulemaking appears appropriate.

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[109] *EPA Trends Report* (*supra* note *47*) at 26 *et seq.* ("All five vehicle types have increased average footprint…"; The overall increase is larger than the individual vehicle type changes due to the changing mix of vehicles over time, as the market has shifted towards larger SUVs and away from smaller sedans/wagons…"; The distribution of footprints across all new vehicles…shows a slow reduction in the number of smaller vehicles with a footprint of less than 45 square feet.")

[110] This is a shift in market share causing an increase in footprint, not a general shift in vehicle size in response to standards.

[111] CAFE Model, Compliance Report output file, standard-setting Central Analysis, Alternative 2.

Appendix VI: Flexibilities and Compliance

Flexibilities

Off-Cycle Technology Credit Process and Enforcement

Safety Assessment of Off-Cycle Credits

NHTSA has proposed to establish a new process to review manufacturer applications for off-cycle fuel economy improvement credits to assess the safety of the proposed technology. NHTSA explained in the preamble to the NPRM that the proposed new process is intended to harmonize with the process already in place for heavy-duty manufacturers seeking off-cycle credits. NHTSA further explained that the process is intended to prevent manufacturers from receiving credits for technologies that impair safety.

The proposed regulatory text contemplates a type approval review process and would add to 49 C.F.R. Part 531 language which states that "[t]echnologies found to be defective, or identified as a part of NHTSA's safety defects program, and technologies that are not performing as intended, will have the values of approved off-cycle credits removed from the manufacturer's credit balance or adjusted if the manufacturers can remedy the defective technology." Manufacturers applying for off-cycle technology credits will be required to state that each vehicle equipped with the off-cycle technology will comply with all applicable FMVSSs and whether the technology has a fail-safe provision. If there is no fail-safe provision for the technology, the manufacturer must explain why not, and discuss whether a failure of the innovative technology would affect the safety of the vehicle.

Auto Innovators understands that NHTSA's primary mission is safety and applauds the agency's commitment to ensuring that technology intended to enhance fuel efficiency does not impair safety. In particular, Auto Innovators understands and agrees that a system or component that is determined to contain a safety-related defect within the meaning of the Vehicle Safety Act must be reported to NHTSA and remedied under the provisions of that Act. Any off-cycle CAFE credits associated with that technology should be removed pending availability of a remedy, and adjusted proportionally to the change in CAFE performance resulting from the safety-related defect remedy.

However, NHTSA's proposal goes far beyond the adjustment of CAFE for systems or components determined to contain a safety-related defect under the Vehicle Safety Act. The proposal contemplates stripping or reducing off-cycle CAFE credits for a technology "found to be defective." A technology can be "defective" for reasons unrelated to safety. For example, an advanced air conditioner compressor could be "defective" in that it fails to cool the cabin, but that certainly has no safety consequences and may not even have consequences related to fuel economy. Whether or not that "defect" should result in loss of off-cycle credits is another issue, but it should not be caught in the net of the safety review.

As to the second criterion identified by NHTSA, which is whether the technology was "identified as part of NHTSA's safety defects program," Auto Innovators challenges the agency to explain what this means. For example, NHTSA may identify a vehicle as a "peer" of a vehicle that is under investigation by NHTSA for a possible safety-related defect. Does the fact that the vehicle was identified as a "peer" in the context of a NHTSA Office of Defects Investigation ("ODI") investigation mean that the peer vehicle cannot enjoy off-cycle credits in the CAFE program? That would be unreasonable and introduce tremendous uncertainty for manufacturers, who would be unable to predict their CAFE credit balances. Even if a fuel-saving technology in a particular vehicle model is itself the subject of an ODI investigation, it should not lose its off-cycle credits under the safety review unless and until it is determined to contain a safety-related defect.

The third criterion identified by NHTSA is whether the technology is "performing as intended," with the corollary that any such technology will have the value of approved off-cycle credits removed or reduced. Again, Auto Innovators challenges the agency to provide more context for this criterion. As with the first criterion, a technology might not be "performing as intended," but have no safety or off-cycle fuel economy consequence from the performance. Using the same example as before, an advanced air conditioner compressor might not cool the cabin "as intended," but there is no safety consequence to that performance, and it should not be caught in the net of the safety review. It is also unlikely that this performance deficit would be identified in an advance type approval review, so this criterion adds substantial uncertainty for manufacturers in their ability to rely on stability in their CAFE credit balances.

The proposal to require manufacturers applying for off-cycle credits to state that each vehicle equipped with the off-cycle technology will comply with all applicable FMVSSs is unnecessary. Each vehicle produced for sale in the United States already must display a certification label stating that it complies with all applicable FMVSSs. Absent a Part 555 temporary exemption applicable to a particular vehicle, no manufacturer may construct a noncompliant vehicle for sale in the United States. There is no need for a superfluous statement of compliance in connection with an application for off-cycle technology credits.

Finally, NHTSA proposes to require manufacturers seeking off-cycle credits for certain technology to state whether the technology has a fail-safe provision and, if not, to explain whether a failure of the innovative technology would affect the safety of the vehicle. It is unclear how this requirement would work as a practical matter. No motor vehicle manufacturer would intentionally install a technology that would fail unsafely. However, that is not the same as requiring an affirmative fail-safe aspect of the design. If NHTSA is signaling that it will not approve a technology for off-cycle CAFE credits unless it is designed with an affirmative fail-safe aspect, Auto Innovators opposes any such requirement. NHTSA has not defined "fail-safe" or identified which technologies need affirmative fail-safe redundancies in order to be considered for off-cycle technology CAFE credits. Nor has NHTSA evaluated whether it is even possible to build a fail-safe design for some technologies and, if yes, at what cost. This criterion should not be adopted in the Final Rule. The uncertainty of not knowing how NHTSA will evaluate this factor for any given technology is untenable for manufacturers who need to be able to develop their product plans with some degree of certainty with respect to their CAFE credit balances, as NHTSA notes elsewhere in the preamble to the NPRM.

Addition of Off-Cycle Technologies to the Credit Menu

NHTSA "proposes to work with EPA to create a quicker process for adding off-cycle technologies to the predetermined menu list if widely approved for multiple manufacturers."[112] Auto Innovators supports timely additions to the predetermined menu list, but only if the menu credit cap is also raised with those additions. Adding additional credits to the menu without expanding the credit cap will likely result in manufacturers installing technologies to the point allowed under the cap, and then ignoring potential additional technologies that could provide additional on-road benefits.[113]

Modification of the Definitions for Passive Cabin Ventilation, Active Engine Warmup, and Active Transmission Warmup

NHTSA discusses proposed changes to certain technology definitions. Auto Innovators provided comment to EPA that opposed the changes in general and that recommended additional lead-time if such changes are adopted.[114]

Proposed Deadlines

NHTSA proposes to add specific deadlines associated with off-cycle credits to its own regulations. The first proposed deadline is to finalize analytical plans by December prior to the start of the model year. The second proposed deadline is for submission of credit applications by September during the model year.

Given that the off-cycle credit process was adopted for CAFE under EPA's authority,[115] we find it odd that NHTSA is proposing to add additional deadlines to the off-cycle credit process that were not proposed by EPA in the GHG NPRM. We suggest that rather than adding additional requirements to the process, NHTSA should work with EPA to make the process as efficient as possible and to jointly propose any necessary process changes.

Setting aside interagency coordination issues, it is unclear whether the deadlines proposed by NHTSA add any greater certainty to the existing process. The first, to submit an analytical plan in advance of the model year, simply restates an existing EPA requirement.[116]

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[112] CAFE NPRM (*supra* note 2) at 49837.

[113] For some technologies, fuel savings for each individual vehicle are relatively low, but cumulatively across a fleet of thousands or millions of vehicles have significant societal benefits.

[114] *See Auto Innovators GHG Comments* (*supra* note 10) at 21 *et seq.*

[115] 2012 Rule (*supra* note 54) at 63134. ("EPA also proposed, under its EPCA authority, to make available a comparable off-cycle technology incentive under the CAFE program beginning in MY 2017. …EPA and NHTSA are finalizing the off-cycle program as proposed…"

[116] *See* 40 C.F.R. § 86.1869-12(d)(1).

However, the challenge has always been to fully develop an analytical plan by that time. Setting a deadline in NHTSA regulations does not change the underlying challenges in preparing such a plan, and the iterative nature of discussions of a plan with EPA.[117] Although NHTSA allows for the extension of the deadline, this is just another process step adding to the burdens of developing a plan. The second proposed deadline, to submit an application, again ignores the challenges in developing a completed application, particularly the data acquisition process. As NHTSA itself notes, some analytical plans may require a year or more of data acquisition.[118] Again, a requirement to apply for an extension of the deadline is another process step, adding burden, but not actually improving the speed of the process itself. While we can see the concerns caused by late, retroactive applications, the Agencies already addressed this issue in the 2020 SAFE Rule.

If NHTSA does choose to finalize the proposed deadlines, additional clarity would be helpful in regard to the second deadline, which has no corresponding EPA requirement. NHTSA specifies that an official credit application must be submitted to EPA prior to September of the given model year. However, "September" could refer to either the calendar year prior to the year for which the model year is named, or the September of the calendar year matching the model year number. Notwithstanding our opposition to the unilateral addition of deadlines to the off-cycle process, if NHTSA chooses to finalize this September deadline, we believe it should be the September of the calendar year matching the model year designation (*i.e.*, that closest to the end of the production period for that model year).

Flexibilities for Air Conditioning Efficiency

Auto Innovators supports the continuation of the A/C efficiency fuel consumption improvement values (FCIVs) in coordination with EPA. We have provided additional comments to EPA on concepts to improve the A/C efficiency flexibility.[119]

Incentives for Advanced Technologies in Full-Size Pickup Trucks

NHTSA proposes to extend the FCIVs for full-size pickup trucks, consistent with EPA's proposal. Auto Innovators supports this flexibility and provides additional comments as follows, consistent with those provided to EPA.

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[117] *Id.* ("The manufacturer may seek EPA input on the proposed methodology prior to conducting testing or analytical work, and EPA will provide input on the manufacturer's analytical plan.")

[118] CAFE NPRM (*supra* note 2) at 49835. ("For example, some manufacturers were required to conduct a four-season testing methodology lasting almost a year…")

[119] *See Auto Innovators GHG Comments* (*supra* note 10) at 26 *et seq.*

Auto Innovators supports the proposed full-size pickup hybrid and over-performance incentive credits through MY 2026.

Auto Innovators supports inclusion of the proposed full-size pickup hybrid and over-performance credits through MY 2026. Although many full-size pickup trucks are quite efficient for their size, weight, and utility, they remain among the highest emitting non-niche vehicles in the fleet. Incentivizing strong hybridization or other technology solutions that yield GHG emission rates 20% or better than their regulatory targets can help encourage manufacturer production and marketing to foster greater long-term consumer market adoption in the transition to EVs.

If minimum production requirements are adopted, Auto Innovators recommends that the Agencies allow them to be met in combination.

The Agencies are proposing to require a minimum 10% penetration rate of strong hybrid or over-performance-qualified full-size pickup trucks out of a manufacturer's total full-size pickup truck production to qualify for credits. Given the current niche nature of such technologies in full-size pickup trucks, Auto Innovators recommends that the Agencies allow manufacturers to combine the production of strong hybrid and 20% over-performance full-size pickup trucks to determine if a single combined minimum production of 10% is reached. Both types of incentivized technology are provided the same proposed credit (20 g/mile) and would likely achieve similar emissions reductions. Such an approach could provide manufacturers with flexibility to develop multiple technical solutions to address different market needs, while encouraging additional fuel-efficient truck technologies in the fleet.

The Agencies should consider expanding hybrid and over-performance credits to other light trucks with similar characteristics to full-size pickup trucks.

EPA notes that full-size pickup trucks face "unique challenges in the costs of applying advanced technologies due to the need to maintain vehicle utility and meet consumer expectations."[120] In recognition that certain other vehicles may face similar challenges, we suggest that the Agencies consider slightly broadening this provision to vehicles with similar customer requirements as full-size pickup trucks. To ensure environmental and energy saving objectives continue to be met, while still providing some additional flexibility with this provision, a utility- and/or weight-based criteria could be developed to determine vehicle eligibility. Individual members of Auto Innovators may choose to comment on more specific concepts to slightly broaden the proposed provision to other vehicles with challenges similar to those of full-size pickup trucks.

[120] GHG NPRM (*supra* note 3) at 43761.

Incentives for Alternative Fueled Vehicles

The NPRM "seeks comment on whether to retain non-statutory flexibilities."[121] Included here are a list of incentives, including a 0.15 factor that is used to incentivize dedicated and dual-fueled alternative fuel vehicles.[122] Examples of alternative fuels include, but are not limited to, electricity and ethanol.[123] The CAFE NPRM indicates without extended discussion that "NHTSA will continue to incorporate the 0.15 incentive factor."[124] Auto Innovators supports this approach. It is imperative NHTSA retain the use of the 0.15 factor in order to respect statutory intent, promote key CAFE energy security and environmental goals, and help ensure the success of the CAFE program. Furthermore, since the CAFE NPRM does not discuss or take comment on removing the 0.15 factor, nor provide any analytical basis for removing it, any other NHTSA action on the 0.15 factor for alternative fuel vehicles other than simply retaining it would be inappropriate. Furthermore, automakers have relied on this 0.15 factor remaining in effect.

Vehicle Classification

Production Measurements for Characteristics Indicative of Off-Highway Operation

NHTSA discusses production measurements of characteristics indicative of off-highway operation in the CAFE NPRM. It explains, "NHTSA's regulations require manufacturers to measure vehicle characteristics when a vehicle is at its curb weight, on a level surface, with the front wheels parallel to the automobile's longitudinal centerline, and the tires inflated to the manufacturer's recommended cold inflation pressure".[125] NHTSA proceeds to reiterate prior and to provide new clarifications including:

1. Vehicle must be classified based on physical production characteristics;
2. Manufacturers must use physical measurements as the basis for values reported to the agency for purposes of vehicle classification;
3. Ground clearance, as well as all the other off-highway criteria for a light truck determination, should use the measurements from vehicles with all standard and optional equipment installed, at the time vehicles are shipped to dealerships; and

[121] CAFE NPRM (*supra* note 2) at 49609.

[122] *Id.* at 49610. (Table I-13.)

[123] 49 U.S.C. § 32901(a)(1).

[124] CAFE NPRM (*supra* note 2) at 49610 and 49816.

[125] *Id.* at 49826.

4. Vehicles with adjustable ride height, such as air suspension, and that permit variable on-road or off-road running clearances should be classified based upon the mode most commonly used or the off-road mode for those with this feature.[126]

Classification based on Physical Production Characteristics

As noted by NHTSA, vehicles classified as light trucks based on "off-road capability" are required to meet four out of five characteristics indicative of off-road operation.[127] We note that these characteristics are minimum ground clearances and minimum ground clearance angles.

Auto Innovators recommends that NHTSA clarify that the production characteristics cited in support of "off-road capability" must meet or exceed the minimum requirements, not that the physical production characteristics must exactly meet calculated values reported to NHTSA.

Physical Measurements as the Basis for Values Reported to the Agency for Purposes of Vehicle Classification

NHTSA's discussion of requiring physical production measurements as the basis for values reported to the agency for purposes of vehicle classification is unclear. On one hand, NHTSA may mean that each vehicle produced must be physically measured. On the other hand, NHTSA may simply mean that the physical measurements of each vehicle produced and classified as a light truck based on off-road capability must be consistent with the characteristics claimed. Auto Innovators believes that the latter is the reasonable approach.

Automobile manufacturers produce millions of vehicles each year. A large automotive plant can produce over 1,000 vehicles in a single day.[128] While some of these vehicles will undergo a partial or full dimensional analysis at completion, most will not. Therefore, manufacturers generally rely on engineering designs to determine the dimensional characteristics of the vehicles produced. A clarification or regulation specifying that each individual vehicle be physically measured for consistency with designs would create an undue and unnecessary cost and time burden.

Vehicle assembly may be performed at multiple locations, including in facilities not controlled by the automobile manufacturer. As a result, it may be insufficient to stipulate that vehicle measurements of off-highway criteria for light truck determination be made "at the time vehicles are shipped to dealerships". This statement may be interpreted to imply that

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[126] *Ibid.*

[127] *Ibid.*

[128] *North American Vehicle Production by State and Plant, 2016-2020*, Wards Intelligence (Mar. 29, 2021). For example, in 2019 Ford's Dearborn Truck plant produced 373,765 vehicles, an average of 1,024 per day assuming 365 days of plant utilization.

measurements made after the vehicle ships from the final manufacturer-controlled assembly location would not apply for the determination of off-highway criteria.

Regarding NHTSA's statement that its "regulations require manufacturers to ***measure*** vehicle characteristics when a vehicle is at its curb weight, on a level surface, with the front wheels parallel to the automobile's longitudinal centerline, and the tires inflated to the manufacturer's recommended cold inflation pressure" (***emphasis*** added).[129] Auto Innovators notes that the regulation actually requires that the characteristics be "calculated".[130] While there is no further definition of these terms in NHTSA's CAFE regulations, we hope that NHTSA views them in the same context as we do – that the regulations allow for the calculation or measurement of off-road characteristics using engineering designs.

In 1976, when the off-highway criteria and definitions were added to Part 523, NHTSA utilized the same dimensional definitions and figure as 1973 SAE J1100. SAE J1100 defines the methodology for calculating dimensions using engineering designs, and the figure used in the 1976 Part 523 shows that the angular dimensions for the off-highway criteria utilizes a point on the tire static loaded radius ("SLR") which can be obtained via calculations, but not by physical measurements (Figure VI-1).

Physical measurements of the angular dimensions of the off-highway criteria will be approximations because the definitions provided in Part 523 utilize a point on the tire SLR which cannot be obtained physically. Hence, the calculated angular measurements based on engineering designs are more accurate than physical measurements, and therefore, we hope that NHTSA will view that the regulations allow for the calculation or measurement of off-road characteristics using engineering designs and that the use of "measure" was not intended to signify a physical measurement of each vehicle.

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[129] CAFE NPRM (*supra* note 2) at 49826. Note, FN 494 in the CAFE NPRM incorrectly cites 49 C.F.R. § 523.5(A)(5), where, from the description, the apparent correct citation is 49 C.F.R. 523.5(b)(2).

[130] 49 C.F.R. § 523.5(b)(2).

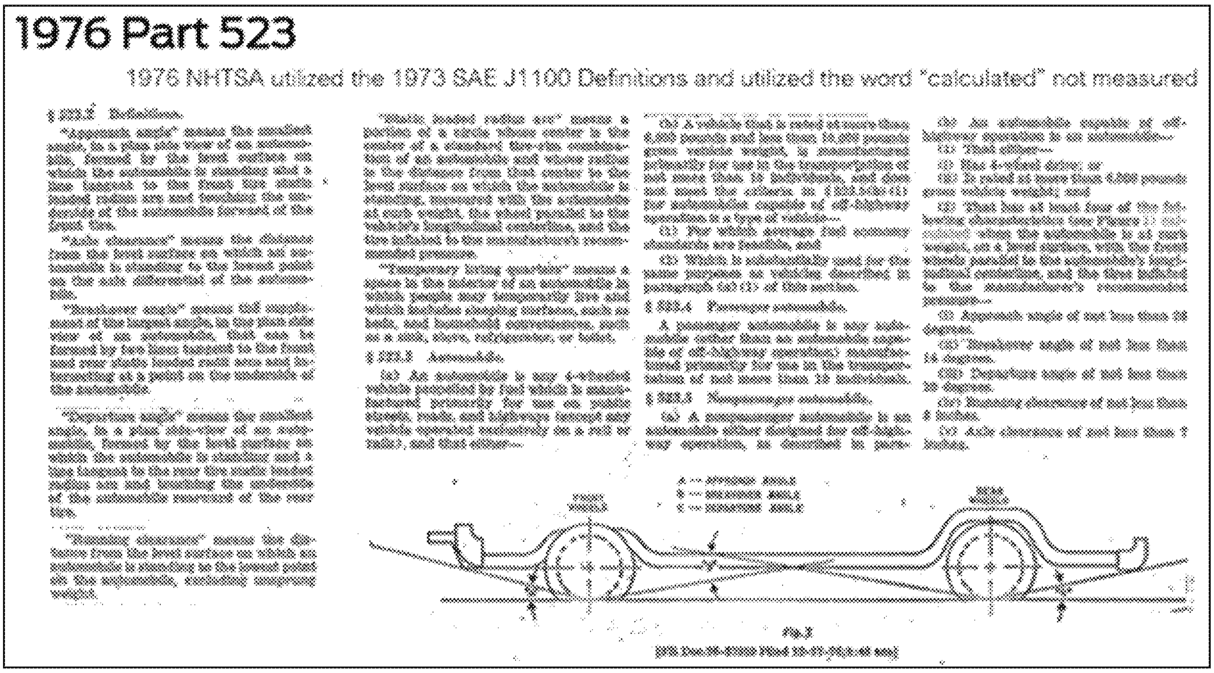

Figure VI-1: 49 C.F.R. § 523.2 (1976)

Auto Innovators recommends that NHTSA clarify that characteristics reported based on engineering designs are acceptable if the analysis is consistent with the vehicles as built. Customers may choose to have dealers install accessories to customize their vehicle that may also affect the off-highway criteria. As this is the customer's choice and beyond a manufacturer's control, these accessories should not be subject to the determination of off-highway criteria.

Subdivision of a Vehicle Model for Purposes of Light Truck Classification

Within any given vehicle model, manufacturers offer numerous standard and optional features across multiple trim levels. The combinations of features can number in the hundreds to thousands for some vehicles. J.D. Power estimated that in MY 2019, over 605,000 different vehicle configurations were built.[131] While many of these build configurations will not affect measurements of off-road characteristics, a substantial number will.

Auto Innovators recommends that NHTSA continue its practice of allowing manufacturers, at their discretion, to subdivide vehicle models into groups classified as light trucks or not depending on their specific features.

[131] Ed Garsten, "Too Many Unwanted Vehicle 'Unicorns' Killing Profits, New Study Shows", Forbes (May 21, 2020), https://www.forbes.com/sites/edgarsten/2020/05/21/too-many-unwanted-vehicle-unicorns-killing-profits/?sh=5c6c83f7120c (accessed Oct. 4, 2021).

Reporting Characteristics Indicative of Off-Highway Operation

The characteristics indicative of off-highway operation are all minimum clearances or clearance angles. While specific measurements of such characteristics may be important to consumers, from a regulatory perspective, the only requirement is to meet or exceed the minimums for the characteristics identified in justifying a vehicle as a light truck. Therefore, the only data requirement should be to report which characteristics indicative of off-highway operation are met for the justification, not specific measurements that may later be challenged.

Auto Innovators recommends that NHTSA only require manufacturers to identify the off-highway characteristics that a manufacturer uses to justify a light truck classification, not each specific measurement. We support NHTSA's requirement to provide clearance data in metric units and encourage EPA to harmonize their units in the special features definition in 40 C.F.R. § 86.1803-01.

Determination of Suspension Settings for Measurement of Characteristics Indicative of Off-Highway Operation

NHTSA requests comment on how to define the mode most commonly used for adjustable suspensions, and, for a test procedure, whether it would be more appropriate to allow manufacturers to define the mode setting for vehicles with adjustable suspensions.[132]

Auto Innovators believes that manufacturers should be able to define the setting for vehicles with adjustable suspension based on the manufacturer recommended setting for off-road use. The most commonly used mode is not necessarily suited to off-road use given the relatively low frequency of such use. Given the multitude of settings that a modern vehicle has, it should generally be the one that provides the greatest ground clearance. Such settings are design features intended to further enable off-road operation. Of course, any mode (e.g., service mode) that is not intended to be used with the vehicle moving should not be the basis of the measurement.

For vehicles with driver-selectable suspension settings, we recommend that manufacturers report and that NHTSA measure off-road dimensional characteristics in the highest ride height setting recommended for off-road use. The appropriate setting should be reported to NHTSA by the manufacturer.

<u>Compliance Test Procedures</u>

NHTSA refers to one or more test procedures for verification of the dimensional characteristics indicative of capability of off-highway operation. These include testing for

[132] CAFE NPRM (*supra* note 2) at 49826.

approach, breakover, and departure angles;[133] testing for running clearance;[134] and testing for front and rear axle clearance.[135]

Availability of Complete Proposed Test Procedures for Review

When NHTSA previously developed a test procedure for verification of vehicle footprint (TP-537-01),[136] formal notice of the proposed procedure was provided in the *Federal Register* and a draft of the test procedure was provided for comment.[137]

In contrast, in the CAFE NPRM, NHTSA alludes to what would be additional test procedures, but has not yet provided such test procedures for comment. Instead, certain aspects of such test procedures are briefly described, but with little of the detail that would be necessary to execute them.

Auto Innovators recommends that a complete draft of any additional test procedures be provided for public review and comment, and that NHTSA make changes to the test procedures it deems appropriate after consideration of such comments before use of such test procedures.

Physical Measurements of Off-Road Dimensional Characteristics

We recommend that test procedures for determination of off-road dimensional characteristics use equipment that verifies that the minimums are met, not that make specific measurements of vehicles. NHTSA should determine the Gauge Repeatability and Reproducibility of its measurement system to determine variation and accuracy in its test procedure and account for this in determining if a vehicle passes the minimum clearance / clearance angle requirements.

Audit Vehicle Consistency

The dimensional measurements of off-road criteria are influenced by the condition and options of the vehicle physically measured. It is critical that audited vehicles are aligned to reported values and options associated with a light truck classification.

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[133] *Ibid.*

[134] *Id.* at 49827.

[135] *Ibid.*

[136] *Laboratory Test Procedure for 49 CFR Part 537, Automotive Fuel Economy Attribute Measurements*, TP-537-01, National Highway Traffic Safety Administration (Mar. 30, 2009), hereinafter "TP-537-01."

[137] Notice of Proposed Rulemaking: Average Fuel Economy Standards, Passenger Cars and Light Trucks; Model Years 2011-2015, 73 Fed. Reg. 24352, 24389 (May 2, 2008).

Audited vehicles should not have any dealer or after-market installed equipment that modifies ground clearances or clearance angles, or that significantly changes vehicle weight distribution. The vehicle should be in new or like-new condition.

Front and Rear Axle Clearance

NHTSA describes that it believes that the definition of axle clearance may be outdated, and proposes that manufacturers identify axle components that are sprung or unsprung.[138] NHTSA also proposes to require manufacturers to report the location used to establish an axle clearance location for vehicles without a differential, and states that it, "will challenge any location on the vehicle's axle found to be located at a lower elevation to the ground than the designed [sic, designated?] location of its axle clearance measurement."[139] However, NHTSA does not propose any specific changes to the definition of "axle clearance."

In summary, NHTSA describes the concerns it is attempting to address as the following:

1. Many SUVs and CUVs that qualify as light trucks have unsprung and sprung components connected together as a part of the axle assembly;

2. Some unsprung and sprung components are located under the axles, making them lower to the ground than the axles and differential; and

3. Vehicles with axle components that are low enough to interfere with off-road operation seem inconsistent with the regulation's intent of ensuring off-highway capability.[140]

Changes in Axle Clearance Requirements

The reporting requirements that NHTSA is informally proposing are a fundamental change in the definition of "axle clearance" in the guise of a test procedure. What NHTSA, in essence, is describing is the creation of an overall ground clearance or suspension clearance requirement using the minimum clearance specification developed for axles, specifically the lowest point on a vulnerable component, the axle differential.

The mere presence of suspension, axle, or other components below the differential (or approximate location thereof for vehicles without a differential) is not an indicator in itself of an interference with off-road operation as NHTSA implies. Both independent and live (solid) axle suspension systems can excel in off-road situations. Live axle systems generally work best for slow off-roading situations and may generally outperform independent axle systems, but independent axle systems allow for faster off-road speeds and can theoretically provide the most

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[138] CAFE NPRM (*supra* note 2) at 49827.

[139] *Ibid.*

[140] *Ibid.*

wheel travel.[141] Further, on independent suspension vehicles, the lower control arms or links of the suspension are relatively strong, less likely to contact the ground at their lowest point (adjacent to the wheel/tire), and offer protection to half shafts.

The use of axle (differential) clearance as an off-road capability characteristic reasonably balances the running clearance characteristic, which only accounts for sprung mass, and the likely presence of unsprung or partially sprung components that extend below that point. Indeed, the running clearance characteristic requires a higher minimum clearance, and the axle clearance characteristic is provided with a lower minimum clearance requirement.

Auto Innovators believes the current definition is sufficient as the differential is the vulnerable component. Other suspension components closer to the tire are not likely to (1) hit the ground due to proximity to the tire, and (2) are much more likely to tolerate the occasional contact in a 4-low/off-road situation.

If NHTSA believes addressing suspension or axle components in independent suspension systems is necessary, it should engage with SAE International to develop a procedure for measuring the clearances of such components, determine typical clearances in vehicles classified as light trucks based on other off-road capability criteria, and seek input from automobile manufacturers and off-road user groups. Only then should NHTSA consider formally proposing appropriate additional off-road characteristics for 49 C.F.R. § 523.5(b)(2) to address such components. NHTSA should not adopt unclear and potentially inconsistent informal changes in clearance definitions through reporting and audit requirements as it seems to be doing here.[142]

Timing of Changes in Interpretation / Enforcement of Axle Clearance Requirements

If NHTSA proceeds with its plan (or a substantially similar plan) to challenge the ground clearances of unsprung or partially sprung components instead of either forgoing action entirely, or researching, proposing, and adopting additional off-road capability characteristics, significant lead-time will be necessary. The "test procedures" NHTSA is proposing may result in shifting a number of vehicles from the light truck classification to the passenger car classification, with impacts to the feasibility of both the car and truck standards. Moreover, such a fundamental change in the off-road capability characteristics can require significant changes to suspension system designs to ensure vehicles meet the new off-road capability characteristics, even if effected vehicles are already off-road capable without such changes. Significant changes to suspension and axle system designs, especially those that require the relocation of components, are typically only made with major redesigns and may even require

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[141] Andrew Boyle, "IFS vs Solid Front Axles Off-Road", CJ Off-Road (updated Jul. 1, 2021), https://www.cjponyparts.com/resources/ifs-vs-solid-axles-off-road (accessed Oct. 2, 2021).

[142] Proposing regulatory changes, or adopting such changes under the guise of test procedures without such data and without specific proposals and opportunity for comment would likely violate the strictures of the Administrative Procedures Act.

waiting for the development of an entirely new platform. Immediately adopting such changes in the guise of "test procedures" is unreasonable. Lead-time well beyond even that of the statutorily required 18-months for new standards will be needed. Barring that, the passenger car and light truck footprint curves would need to be revisited to avoid unintended changes in standard stringency.

If NHTSA modifies the definition of "axle clearance" or changes its interpretation of the definition, through test procedures or otherwise, to include components or locations other than the bottom of the differential, it should not reclassify vehicles on the basis of such changes until MY 2027 at the earliest, and the footprint-based target curves should be reassessed.

<u>49 C.F.R. § 571.3 MPV Definition</u>

For purposes of the Federal Motor Vehicle Safety Standards, NHTSA has defined "multipurpose passenger vehicle" as "a motor vehicle with motive power, except a low-speed vehicle or trailer, designed to carry 10 persons or less which is constructed either on a truck chassis or with special features for occasional off-road operation."[143]

The definition does not define "special features for occasional off-road operation." NHTSA has, however, addressed this issue in several letters of interpretation beyond the 1979 letter to Subaru that is cited in the preamble to the NPRM. In 1998, in a letter to Charles Jandecka, NHTSA identified several features that facilitate "occasional off-road operation," including four-wheel drive, large all-purpose tires, large suspension excursions and high ground clearances. In a 1997 letter to Mike Hofstätter, NHTSA said that elevating the vehicle body by 50-60 mm is not enough, by itself, to consider the vehicle to be equipped with special features for occasional off-road operation. In a letter to Mark Bernten in 1996, NHTSA said that four-wheel drive is one special feature allowing use for off-road operations. In a letter to Michael Sens in 1992, NHTSA confirmed that a vehicle with four-wheel drive and several characteristics related to high ground clearance (such as approach angle, axle clearances, etc.) was properly classified as an MPV. In 1989, in a letter to Clifford Anglewicz, NHTSA identified high approach and ground clearances, capability of amphibious operation with special equipment and suitability for rough terrain operation as features that would support an MPV classification for a vehicle. Also in 1989, in a letter to M.J. Yoon, NHTSA stated that the combination of four-wheel drive and high ground clearance when measured in terms of the approach angle, the departure angle and the running clearance would be considered features that facilitate occasional off-road operation and therefore support an MPV classification.

In the preamble to the NPRM, NHTSA noted that the CAFE classification rules identify five characteristics that would be considered "special features" for off-road operation." These characteristics relate to the approach angle, the breakover angle, the departure angle, the running clearance and the front and rear axle clearances. These are found in 49 C.F.R. § 523.5(b)(2).

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[143] 49 C.F.R. § 571.3.

NHTSA has requested comment on whether manufacturers use any other "special features" besides these five characteristics to qualify vehicles as MPVs. As noted in the letters of interpretation cited above, NHTSA has explicitly recognized certain other features, including large all-purpose tires, large suspension excursions and capability of amphibious operation, as eligible to be considered "special features for occasional off-road operation." By way of example, other features that facilitate occasional off-road operation include brush guards, and protective underbody skid plates.

NHTSA also requested comment on whether NHTSA should link the definition of MPV in the FMVSSs (as it relates to special features for occasional off-road operation) to 49 C.F.R. § 523.5(b)(2).

Auto Innovators opposes the linkage of the FMVSS definition of MPV to the CAFE ground clearance metrics in 49 C.F.R. § 523.5(b)(2). The guidance in the interpretation letters cited above has proven sufficient to allow auto manufacturers to make classification decisions for the FMVSSs. The fact that there have not been any interpretations published on this topic since 1998 suggests that there is no lingering uncertainty that needs to be addressed at this time.

Moreover, linking the FMVSS definition of MPV to the CAFE ground clearance metrics would significantly reduce FMVSS classification flexibility that is currently available to manufacturers, as confirmed in the above-cited interpretation letters. NHTSA has not cited any safety need to amend the FMVSS definition of MPV to conform to the CAFE definition. Indeed, NHTSA does not cite any reason at all for this concept, except to address "uncertainty" that does not, in our view, exist.

We also note as an example of a potential unintended consequences and additional reason to avoid revision of the definition of MPV unless careful evaluation is performed as to all potential impacts that one consequence of the FMVSS definition of an MPV being changed would be a loss of solar-thermal off-cycle credits for any vehicle that would no longer be considered an MPV. One fuel saving off-cycle credit available in the CAFE program is to reduce the solar transmittance of the glass, thus reducing cabin heating from sun. With more window tinting (less solar transmittance), the air conditioner does not have to work as hard to cool the cabin, thus saving fuel. But a vehicle that loses the MPV classification would not be allowed to tint the rear and rear side windows. This in turn would increase the work of the air conditioner, reducing real-world fuel economy, and reduce off-cycle credits. This is an increase in stringency which has not been considered in the proposed rule.

Auto Innovators urges NHTSA to retain the status quo in Part 571 and refrain from amending the definition of MPV for the FMVSSs.

CAFE Reporting Templates

CAFE Credit Value Template

Background

NHTSA first proposed to require manufacturers to submit credit transaction information in the proposed Safer Affordable Fuel-Efficient Vehicles rulemaking.[144] In support, NHTSA cited a need to facilitate a transparent, efficient credit trading market.[145] Automobile manufacturers (the entities that would presumably benefit according to NHTSA's assertions) and their trade associations filed comments opposing the proposed requirement.[146] Not a single automobile manufacturer supported the proposed requirement. NHTSA notes that an average of 25 credit transactions are submitted to the agency annually,[147] indicating that the CAFE credit trading market is functioning properly under existing regulations.

Despite these objections, NHTSA finalized a requirement to report, "the price paid for the credits including a description of any other monetary or non-monetary terms affecting the price of the traded credits, such as any technology exchanged or shared for the credits, any other non-monetary payment for the credits, or any other agreements related to the trade."[148] NHTSA also provided that it would consider claims that credit trade information submitted is entitled to confidential treatment.[149]

NHTSA now proposes to require entities trading credits to use and submit the NHTSA "Credit Value Reporting Template" (OMB Control No. 2127-0019, NHTSA Form 1621) when a credit trade is executed.[150] The data required by template and previously promulgated reporting requirements fail to achieve the stated objectives, are unnecessary to the

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[144] The Safer Affordable Fuel-Efficient (SAFE) Vehicles Rule for Model Years 2021-2026 Passenger Cars and Light Trucks: Notice of Proposed Rulemaking, 83 Fed. Reg. 42986, 43449 (Aug. 24, 2018).

[145] *Ibid.*

[146] 2020 SAFE Rule (*supra* note 28) at 25219.

[147] OMB Information Collection Request 2127-0019-001, *Corporate Average Fuel Economy Reporting* (Oct. 15, 2021).

[148] 49 C.F.R. § 536.5(c)(5). Though an information collection request was submitted to the Office of Management and Budget (OMB) for the general reporting template, it does not appear NHTSA accounted for, considered alternatives to, or tailored the requested information.

[149] 49 C.F.R § 536.5(c)(6).

[150] CAFE NPRM (*supra* note 2) at 49831.

administration of the CAFE program, and are overly burdensome. Further, the requirements exceed NHTSA's statutory authority.

The data required by the credit valuation reporting requirements and template fail to achieve the stated objectives, and/or are unnecessary to carry out the CAFE program.

NHTSA explains that a "lack of information regarding credit transactions means entities wishing to trade credits have little, if any, information to determine the value of the credits they seek to buy or sell." [151] When NHTSA first proposed to require disclosure of information related to the value of traded credits in the 2020 SAFE Rule, not a single automobile manufacturer supported the need for such action, indicating the absence of a need to make such information public in order to facilitate credit trading. NHTSA itself acknowledges that numerous trades are occurring on an annual basis. Many automobile manufacturers continue to suggest that reporting monetary values, and particularly non-monetary values and contractual terms, associated with traded CAFE credits is unnecessary. Automobile manufacturers are the most likely (and only known current[152]) parties to trade CAFE credits. Automobile manufacturers wishing to engage in credit trading generally negotiate terms through direct contact. There is no mystery or confusion to be resolved through government intervention. Furthermore, data regarding monetary and non-monetary valuation and contractual terms is largely confidential business information, and should not be disclosed to the public by NHTSA. Some contracts have multiyear provisions that can provide significant insight into participants' future financial performance based on yet-to-be executed trades. This raises substantial confidentiality concerns whether NHTSA intends to disclose the data to the public or not.

Aggregated data would have little practical (or even academic) value given that credit transactions likely have a wide range of values depending on market forces (relative supply and demand) at the time a trade is made and regulatory compliance considerations applicable to the specific traded credits, which can vary based on credit vintage, source, and anticipated future use of the credit for the purchasing party. Even if the inputs into a template are properly understood, the dynamic nature of credit trading decisions renders a historical snapshot of business considerations moot. This is particularly true in a regulatory regime where stringencies are dramatically changing.

Moreover, ill-defined requests for non-monetary valuation are not only nearly impossible to quantify and use as a meaningful point of comparison, but such requests significantly underestimate the complicated commercial and manufacturing relationships manufacturers may have with other companies. There is no possible "template" that can adequately cover the entire range of possible monetary and non-monetary exchanges between manufacturers. Trying to categorize complex contracts, business relationships, production arrangements, and exchanges of technology into simple topics such as "chassis technology" or

[151] *Ibid.*

[152] Though NHTSA notes that entities other than automobile manufacturers may purchase credits under the CAFE program, to date no such transactions have occurred.

"off-cycle technology" is simply not possible, and provides virtually no value to the administration of the CAFE program. This is especially true when credits may be generated by new market entrants, and value may be in the form of options, equity interest, royalties, real estate, or other assets. Entering such data into a template may cause increased confusion for NHTSA and misinterpretation. Credit trade decisions are dynamic, and a function of multiple broader considerations that do not lend themselves to input cells in a template. With an imprecise and non-standardized method of quantifying non-monetary factors to be reported in credit trades, the resulting impact on industry will be a burdensome attempt to quantify complicated transactions with little utility to NHTSA or the general public.

NHTSA also describes its desire for information on credit trade values to aid in the determination of the "true cost" of compliance to better assess the impact of its regulations on industry, and to provide insightful information for the development of future rulemakings.[153] We question the need for such specific knowledge. There is no practical reason to require reporting of CAFE credit values and contractual terms for determining compliance with existing regulations. For the purposes of future rulemaking, in determining maximum feasible standards, NHTSA is prohibited from considering the trading, transferring, or availability of credits.[154] Therefore, data in the Credit Value Reporting Template is not informative to the standard-setting process. Furthermore, attempting to calculate the true cost of compliance with a mixture of monetary and non-monetary terms, the latter of which are heterogenous in nature, would be a nearly impossible task. Finally, to whatever limited extent such data are informative to the rulemaking process, the CAFE civil penalty rate serves as a reasonable surrogate for the maximum price a manufacturer would logically pay for a CAFE credit in either monetary or non-monetary terms. Requiring highly sensitive confidential information is simply not necessary, and the risks of a breach in confidentiality outweigh what little value NHTSA may derive from such data.

Given the limited value to the public given its confidential nature, and prohibitions against considering such data for standard-setting purposes, the data required by the Credit Value Reporting Template is unnecessary to the administration of the CAFE program.

NHTSA's fifth objective of greater oversight of CAFE credit trades is also unnecessary and not served by the data requirements of the Credit Value Reporting Template. In originally describing its need for greater oversight, NHTSA cited protection against fraud, manipulation, market power, and abuse.[155] NHTSA's concerns seem more hypothetical than real, and more importantly, NHTSA fails to describe how the desired information will aid in preventing or

[153] CAFE NPRM *(supra* note 2) at 49831.

[154] 49 U.S.C. § 32902(h)(3).

[155] 2020 SAFE Rule (*supra* note 28) at 25220.

addressing them.[156] If NHTSA's concern is losing track of the origin of the credits (*i.e.*, before they were first traded) it could assign an identifier to the credits consisting of a manufacturer code, model year, and compliance fleet designation (*e.g.*, MFR_2021_DPC) that would be reported as part of the credit transaction.

The monetary and/or non-monetary value of traded CAFE credits and related contractual terms are not needed to protect against fraud. NHTSA already requires use of the Credit Transaction Template. Before executing a trade specified in a Credit Transaction Template submission, NHTSA presumably verifies sufficient credits exist. Indeed, NHTSA specifically states that it "will not honor any instructions to trade or transfer more credits than are currently held in any account. NHTSA will not honor instructions to trade or transfer credits from any future vintage (*i.e.*, credits not yet earned). NHTSA will not participate in or facilitate contingent trades."[157] To the extent fraud may occur elsewhere, it is the responsibility of parties participating in a trade to perform their own due diligence and to create such contractual terms as they deem necessary to address fraudulent actions. In addition, NHTSA has provided regulatory provisions to address fraud that do not require knowledge of monetary or other valuation of traded credits or the specific contractual terms between the parties involved in a trade.[158]

The potential for market manipulation, power, and abuse and specifically how NHTSA's collection of contractual terms related to credit trades could prevent or address them is even more doubtful than fraud. Participants in the CAFE credit market are generally limited to automobile manufacturers, all of which are likely to perform their due diligence prior to buying and selling credits. While some market power likely exists for certain credit sellers and buyers given the limited number of participants in the market, each manufacturer makes their own compliance plans and therefore has a degree of control in whether they will become buyers, sellers, or disinterested parties in the market. NHTSA also provides annual CAFE performance reports on its CAFE Public Information Center.[159] These reports publicly share information on fleet and manufacturer compliance, credits and credit trades, providing a way for interested parties to monitor potential "fraud, manipulation, market power, and abuse."

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[156] Further, the existence of a concrete and defined civil penalty rate for the CAFE program provides any automaker with the ability to forgo credits trades, particularly if there are concerns regarding "fraud, manipulation, market power, and abuse," and still have a clear and defined path for compliance with the CAFE program.

[156] 49 C.F.R. § 536.8(d).

[157] 49 C.F.R. § 536.8(d).

[158] 49 C.F.R. § 536.8(f) and (g).

[159] *See*, CAFE Public Information Center, https://one.nhtsa.gov/cafe_pic/cafe_pic_home.htm (accessed Oct. 22, 2021).

NHTSA's CAFE credit value reporting requirements and Credit Value Reporting Template exceed NHTSA's statutory authority.

Though NHTSA has authority to require reports necessary for it to carry out the CAFE program,[160] such authority is not limitless. NHTSA's proposed requirements to report the monetary and non-monetary valuation of traded CAFE credits, and other contractual terms (and in this case every contractual term, inclusive of terms completely unrelated to the exchange of CAFE credits) between participating parties exceed what is necessary to carry out the CAFE program. Requiring non-standardized data and unquantifiable contractual terms is clearly unnecessary for the determination of manufacturer compliance with the CAFE program, and their use in rulemaking is limited at best with other, better options, such as estimates, sensitivity analyses based on the CAFE civil penalty rate, or comparisons of model runs with manufacturers separated and aggregated, available. The data required by the Credit Value Reporting Template (and the underlying regulatory requirement) will not achieve the described objectives for requiring it, nor is the need for those objectives justified in the first place. In short, NHTSA has failed to justify a need for the data required by the CAFE Value Reporting Template, and even if there were such a need, NHTSA has failed to justify this burdensome and intrusive requirement.

The credit valuation reporting requirements and template are overly burdensome.

Prior to January 1, 2022, no standard CAFE credit template existed for manufacturers to use. Each transaction was submitted to NHTSA by trading partners using their own format. To that end, beginning with MY 2021, credit trades will be executed through the submission of the Credit Transaction Template (OMB Control No. 2127-0019, NHTSA Form 1475).[161] This form includes all of the information necessary for NHTSA to track traded credits from their original source to their ultimate destination. No further information is necessary for NHTSA to execute its duties under the CAFE program.

Nevertheless, NHTSA is now proposing another reporting template which adds additional information requirements to those previously promulgated. NHTSA itself estimates that the reporting burden already associated with the CAFE program is over 4,000 hours per year at a cost of $208,000.[162] The proposed additional requirements are estimated to increase reporting burden by 266 hours and almost $17,000.

There are additional administrative burdens that NHTSA has not considered beyond the simple effort of filling in a template. This is particularly true with the valuation of credits for non-monetary compensation. While manufacturers are likely to consider the relative value of what they are receiving and what they are giving, assignment of a specific monetary value to

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[160] 49 U.S.C. § 32907(b)(1).

[161] 49 C.F.R. § 536.5(c)(5).

[162] CAFE NPRM (*supra* note 2) at 49846, Table IX-2.

non-monetary considerations is likely not straightforward or clear, requiring significant research and numerous meetings with coworkers to derive an equivalent monetary value. In addition, non-monetary terms can be highly sensitive, and their subject matter tightly restricted even within a company, requiring additional effort to obtain necessary management permissions for access.

CAFE Projections Reporting Template

Auto Innovators provides the following recommendations regarding the CAFE Projections Reporting Template.

Macros for Creation of Public Versions of the CAFE Reports

For air conditioning and off-cycle credits, we have concerns over the protection of certain proprietary information. It is our understanding that particular "forecast volumes" are not redacted within the "public versions" of the pre- and mid-model reports. Due to the public availability of this information, it would be possible to back-calculate the forecast volumes for vehicles with certain technologies.

Additionally, we have a number of guidance questions regarding the pre- and mid-model year reports. The first question we have is whether or not manufacturers will still be responsible for creating the public version of these reports? Or will NHTSA be creating these public versions? We respectfully request and recommend that manufacturers create the report with Confidential Business Information (CBI) included in that particular version and submit it under the existing processes.

Other Requests on the CAFE Projections Reporting Template

Our first request refers to the collection of tabs as a whole. For all items, we respectfully request that NHTSA indicate which fields are mandatory (regulatory requirement), and which are optional, similar to EV-CIS.

We request that NHTSA align its data requirements more closely with the data that is available to manufacturers for pre- and mid-model year reports. The pre-model year report is largely a projection. By regulation, the report is due for each current model year during the month of December.[163] NHTSA has stated that it uses the data supplied by manufacturers for the purpose of modeling fuel economy standards. We do not believe that valuable modeling can be achieved using detailed projections from before or shortly after the beginning of the model year for attributes like paint colors or lighting packages, that are currently required information in the proposed reporting template. Whereas at the end of the model year, when a manufacturer submits their final report to the EPA, the actual data on paint colors and lighting packages are

[163] 49 C.F.R. § 537.5(b)(1). ("...*e.g.*, the pre-model year report for the 1983 model year must be submitted during December, 1982.") (Internal parenthesis removed.)

known. We believe that NHTSA would achieve better data modeling using end of model year data that manufacturers submit to EPA.

At a minimum, we request that NHTSA limit their detailed data collection for the pre-model year report as follows. We agree that fuel economy data is appropriate from sub-configuration to model type levels, as this is required to complete a fleet average calculation. Air conditioning and off-cycle credit data should be minimized, and on a fleet-level basis for the pre-model year report because so much is projected at that point in time. By the mid-model year report, a manufacturer is reasonably able to supply the data NHTSA is requesting in the template.

Currently, manufacturers submit a minimum of two projected fuel economy reports to NHTSA, and a final, end of model year report to EPA. The NHTSA Part 537 regulations allow for "Other formats, such as those accepted by the EPA, which contain all the information in a readily identifiable format."[164] This format flexibility enables manufacturers to use a common format to produce reports for both Agencies. If NHTSA implements their specific reporting template with codes different than EPA uses, manufacturers will be required to translate both sets of codes for the same products to create the detailed sheets that NHTSA is now requiring. For example, NHTSA has seven values for Fuel System and EPA has 11. NHTSA has three values for Drive System / Mode and EPA has five values. We recommend that NHTSA modify their template to use EPA values as input values. If NHTSA needs alternate values for their internal analysis, then the template could provide that translation. Alternatively, we request that EPA and NHTSA align on their reporting values before manufacturers have to redesign their information technology systems to accommodate the new NHTSA template.

In the previous NHTSA regulations, vehicle classification used to be based on Basic Vehicle Frontal Area for separating Heavy Duty Vehicles ("HDVs") and Light Duty Vehicles ("LDVs"). The classification of HDVs and LDVs are now based upon its Gross Vehicle Weight Rating ("GVWR"). Since this distinction is being based off of a singular classification of GVWR, we respectfully request eliminating the reporting requirement of other classifications such as Basic Vehicle Frontal Area.

In the "Summary" section of the template under "Issue Details" and "Alternative Dual Fuel", the template is calculating fuel economy values for alternative dual fuel, although alternative dual fuel values were not inputted in the other tabs. Therefore, we formally request that NHTSA adjust these cells in order to have them calculate their formulas properly. We request that you include "blank" or "NA" when there is no alternative dual fuel data inputted.

Additionally, in column "AY" and field "ETW," it appears as if test weight is calculated automatically from curb weight. We recommend that NHTSA change from using an automatic calculation to user input for flexibility in how we manage vehicle compliance.

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[164] 49 C.F.R. § 537.7(b)(3).

In general, we appreciate where NHTSA has aligned with EPA coding, for example, the Carline Class code. Our concern is that this data is being collected on the *sub-configuration* level that is not aligned with the definition. The carline class is unique for each model type and so collecting this data on a *sub-configuration* level is very repetitive and inefficient. We believe it would be more efficient for NHTSA to collect this and other data in a manner better aligned with the definitions. We recommend that NHTSA update their template to collect model type level data on the model type worksheets.

Footprint and Subconfig Tab

Cell AM16 in the Footprint and Subconfig tab is requesting information for “Auxiliary Emission Control Devices” (AECD). While we understand what you are asking for, we would like to point out that AECD is a separate technical term that differs from conventional “emission control devices.” We formally request that NHTSA remove the term “Auxiliary” so the cell is named “Emission Control Device.”

Auto Innovators would like to provide comments regarding the Footprint and SubConfig tab in columns “BU, BV, BW, BY, BZ, CA, CB, CE, CI” under the Base and Alternative Fuel field. Specifically, when conventional gasoline is selected under base fuel in column BI and no alternative fuel input is done, we recommend that columns should not display any MPGe values when "conventional gasoline" is selected.

For the Production Volume fields on the configuration, base level and model type tab, we question why production volumes are user inputted, as opposed to automatically calculated. Once production volume is entered for each carline on a subconfiguration level, the values should be carried over wherever carlines and their corresponding production volumes are present in each of the higher-level tabs such as configuration, base level, and model type.

NHTSA proposes “that the CAFE Reporting Template be modified to combine the footprint attribute information and model type sub-configuration data for the purposes of matching. NHTSA uses this information to match test data directly to fuel economy footprint values for the purposes of modeling fuel economy standards.”[165] We believe that the sub-configuration and footprint data should not be combined. A sub-configuration can only have a single fuel economy value and yet may contain multiple footprints / wheelbases because sub-configurations are largely based on powertrain, weight and road load attributes.

49 C.F.R. Part 537 requires footprint data for “…each unique model type and footprint combination.”[166] NHTSA has defined that the base (standard) tire is to be used for footprint data. However, footprint data on the template is required to be provided on a sub-configuration level. A manufacturer can have hundreds of sub-configurations in a single fleet. It is not efficient nor beneficial to either keep repeating the same footprint data across a sub-

[165] CAFE NPRM (*supra* note 2) at 49830.

[166] 49 C.F.R. § 537.7(b)(3).

configuration or to further subdivide a sub-configuration by the multiple wheelbases in them. It will not help NHTSA to find the applicable footprint record for a physical vehicle that's been obtained as part of the footprint validation program to have repeating values in the template. We recommend that footprint data be required on carline level, which is part of a model type definition, aligned with the submission format required by EPA. We look forward to working with NHTSA in future workshops.

NHTSA states "Each sub-configuration variant within a model type has a unique CO_2 and CAFE value. Manufacturers combine other vehicles at the configuration, base level and then finally at the model type level for determining CAFE performance."[167] We would like to clarify that each sub-configuration variant may or may not have a unique CO_2 and CAFE value as some sub-configuration variants are untested. Also, we request that NHTSA clarify their "other vehicles" comment. Vehicles from different nameplates may be combined at the sub-configuration, configuration, and base level because these are defined by attributes like powertrain, weight and total roadload horsepower but not at the model type level. A model type is defined by carline and so "other vehicles" wouldn't apply in this context.

Data Definitions Tab

Under the "Data Definitions" tab, in row 66, it says, "Type of Overdrive/Torque converter", but in "Footprint & SubConfig" tab, it is asking for "Presence of over drive (Y/N). We respectfully request you change the data definition description from "Type" to "Presence" of Overdrive to match Col O in Footprint & Sub Conf tabs. Additionally, in the "Data Definitions" tab, cells F99, F100, F172, and F173, the total drive ratio min & max descriptions should have only 1 decimal place (##.#) to match input in Footprint and SubConfig tabs.

Vehicle Classification Tab

Auto Innovators requests changes under the "Vehicle Classification" tab, under columns "AC" and "AD." Per 49 C.F.R. § 537.7(c)(4)(xvi)(B)(2), only cargo volume is required to be reported, thus cargo bed width and length is not required. We respectfully request that NHTSA remove "Cargo bed width and length" - as cargo volume is already requested. We believe this is unnecessary extra burden that could result in conflicting data.

Fuel Economy Base Level Tab

In column AI, under 40 C.F.R. § 600.208-12(a)(4)(5), the Combined (CMB) formula is incorrect. We suggest that NHTSA use a harmonic average for the CMB formula. The current 55:45 ratio is used only for vehicle configuration calculation. Additionally, we prefer a direct user input, rather than automatic calculation. Column AI, under 40 C.F.R. § 600.002, we believe that automatic calculation is not necessary. We request that "direct input" is used, rather than an automatic calculation for the CMB.

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[167] CAFE NPRM (*supra* note 2) at 49830.

Air Conditioning Efficiency Tab

In the Air Conditioning Efficiency tab, under column AC for the Advanced Technology Compressor, we respectfully request that NHTSA allow additional input columns for both existing and approved technologies. This is to ensure that future technologies are accounted for as they come to market and are applicable under the credit program.

Off-Cycle Tab

NHTSA states: "Finally, we are proposing corrections to the CAFE Reporting Template to collect information on off-cycle technologies. The proposed changes match the format of the data with the EPA off-cycle database system. For example, manufacturers report to EPA high efficiency lighting as combination packages, so NHTSA is proposing to change its form to reflect this same level of information."[168] We disagree that NHTSA has aligned their template with EPA's reporting. To report lighting credits to EPA, manufacturers report the various combinations of lamp positions that qualify for credit on a model type basis. There could be one or more combinations within a model type. This is not the same as reporting via a numbered lighting package. NHTSA's template has 30 lighting packages, which may seem generous, but is actually not sufficient for three separate fleets that may contain tens of model types with one or more combinations each. We recommend that NHTSA align the reporting template with EPA reporting so that components and volumes are provided within model types, but a lighting package "number" is not needed.

Submission Method

We request that NHTSA update Part 537 to permanently allow manufacturers to use NHTSA's secure email to submit their reports instead of requiring manufacturers to mail the template on two CD-ROMs.[169] This method of submission has been successfully used for multiple reporting periods during the COVID-19 pandemic. NHTSA has deemed the email submission to cafe@dot.gov sufficiently secure for the submission of the Credit Transactions Reporting Template. Electronic submission via email enables key workplace independence by not requiring hard copies which may not be possible for off-site workers. It eliminates the need for physically mailing and tracking those packages. It enables a timelier submission that can be done electronically in seconds, instead of a physical package being mailed during a peak holiday season to an empty office when employees are on vacation.

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[168] *Ibid.*

[169] 49 C.F.R. § 537.5(c)(4).

CAFE Credit Transaction Template

Microsoft VBA Error in ASTM Rounding Module

It seems as if the NHTSA CAFE Credit Transaction Template, version 2.3 contains an incompatibility issue for some users in the ASTM Rounding Module (Figure VI-2). We request that NHSTA adjust the code in order to ensure compatibility across all platforms.

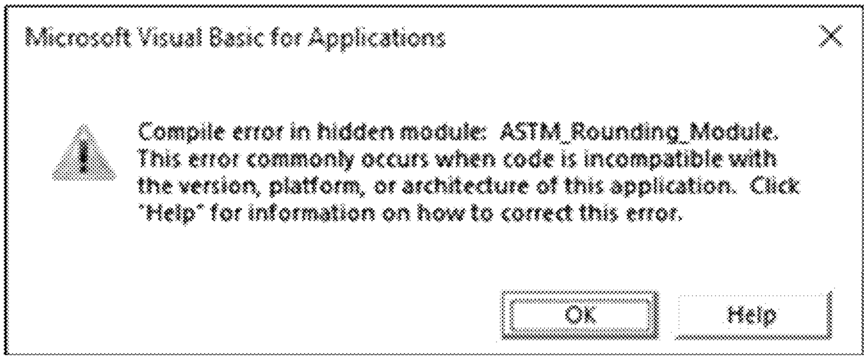

Figure VI-2: Error Message Encountered When Enabling Macros in the CAFE Credit Transaction Template

Appendix VII: Comments on NHTSA's (and EPA's) Analysis of Benefits and Costs

Both NHTSA and EPA take similar approaches to assessing benefits and costs in their respective regulatory impacts analysis. Given this similarity, in this section Auto Innovators provides comment on both the NHTSA Preliminary Regulatory Impact Analysis ("NHTSA RIA")[170] and the EPA Regulatory Impact Analysis ("EPA RIA")[171] (collectively the "RIAs").

Comments on Analysis of Benefits

Private Fuel Savings

Payback Period

The largest category of benefits in the rulemakings is private fuel savings for motorists.

The amount of private fuel savings due to the standards should be based on a proper baseline characterization of the amount of fuel-saving innovation in ICE vehicles that will occur if the MY 2024-2026 vehicles are not subject to stricter standards. The Agencies have recognized this issue. The RIAs assume that innovations that pay for themselves within 2.5 years of vehicle ownership will be implemented by manufacturers voluntarily and are therefore incorporated into the baseline fleets from MYs 2024-2026.

NHTSA asks for comment on whether, instead of making this 2.5-year assumption, it should assume that the new technologies will be channeled by automakers to accomplish further improvements to performance, on the assumption that consumers value the performance gains even more than the net-beneficial fuel savings.[172] Under this scenario, all the innovation-related gains in fuel economy and GHG reduction would be assigned to the stricter standards, and none to market forces.

Auto Innovators urges caution on this point because the Agencies have not yet developed a practical analytic approach to value the private (hedonic) benefits of performance (or the opportunity costs of foregone performance gains from stricter standards). Unless and until the agencies are prepared to quantify the monetary value of performance as well as fuel savings, then an analytic move in the posited direction seems premature. Moreover, the current 2.5-year payback assumption is consistent with the reality that consumers are heterogenous

[170] *Preliminary Regulatory Impact Analysis: Proposed Rulemaking for Model Years 2024-2026 Light-Duty Vehicle Corporate Average Fuel Economy Standards*, National Highway Traffic Safety Administration (Aug. 2021), hereinafter "*NHTSA RIA*."

[171] *Revised 2023 and Later Model Year Light-Duty Vehicle GHG Emissions Standards; Regulatory Impact Analysis*, U.S. Environmental Protection Agency, EPA-420-R-21-018 (Aug. 2021), hereinafter "*EPA RIA*."

[172] NHTSA RIA (*supra* note 170) at 49639 and 49729.

(some strongly value performance, others value fuel economy, and still others value both to various degrees). And the current assumption captures the reality that the typical consumer does not account for anything close to 15 years of fuel savings when they compare alternative models with respect to price, fuel savings and other important attributes.

On the other hand, Auto Innovators recognizes that there is uncertainty as to whether 2.5 years is the best approximation of a complicated set of consumer and manufacturer perceptions, as explained by the Agencies in the CAFE and GHG NPRM preambles, in the NHTSA and EPA RIAs, and by the National Academies.[173] Auto Innovators supports sensitivity analysis of alternatives to the 2.5-year point estimate, possibly as low as one year and as high as four years.

A recent analysis by economists at Resources for the Future ("RFF"), which relies primarily on revealed-preference studies of changes in fuel prices, suggests that a somewhat longer payback period is supportable.[174] The RFF analysis is worthy of consideration.

The RFF analysis does not consider the stated preference studies that provide a basis for the 2.5 year estimate and that were cited by the National Research Council in 2015 and by the Agencies in previous rulemakings. One of the advantages of the stated-preference approach is that study designs can directly address consumer reaction to new technologies; the findings of the revealed preference studies are more difficult to interpret. They may offer more insight about consumer reaction to changes in fuel prices than to changes in technologies.[175] A well-known weakness of the stated-preference approach is that consumer responses to hypothetical questions are not necessarily validated when those same consumers make decisions in the marketplace.

Overall, given that the existing body of evidence about consumer valuation of fuel economy does not reach definitive findings, a sensitivity-analysis approach to the 2.5-year payback period is warranted.

Energy Savings Associated with Electric Vehicles

In both EPA and NHTSA analyses, a large portion of the projected benefits are attributed to fuel savings, either from using less energy to travel the same number of miles, from switching to a lower cost fuel (electricity), or from a combination of both. At this time, there is a tremendous amount of uncertainty related to the future of the electricity grid, and electricity

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[173] *2021 NAS Report* (*supra* note 37).

[174] Kevin Ankney, Benjamin Leard, Joshua Linn, Virginia McConnell, "What Should Federal Agencies Assume for How Much Consumers Are Willing to Pay for Fuel Cost Savings," Resources (Sep. 22, 2021), Resources.org.

[175] One of the few revealed preference studies to consider change in technology as well as change in fuel price is Benjamin Leard, Joshua Linn, Yichen Christy Zhou, "Do Consumers Value Fuel Economy and Performance? Evidence from Technology Adoption," Review of Economics and Statistics (2021). In press.

rates (both residential rates including transmission costs, and whatever rates that may be offered to consumers at public vehicle charging infrastructure).

Researchers and scientists from National Renewable Energy Laboratory ("NREL") have highlighted challenges with integrating variable renewable energy generation into the electric grid beyond 30% generating capacity, with challenges including higher transmission costs, and costly overhead associated with storage and standby generation.[176] Notably, states with higher portions of renewable electricity generation like Hawaii, California and Massachusetts also have some of the highest electricity rates in the country.[177,178] Studies from the NREL have outlined how renewable power sources, such as solar, could be integrated into the electric grid to meet the nation's ambitious emissions goals, and these studies acknowledge that costs increase when the timing of electricity generation and electricity demand are not synchronized.[179] Without public charging infrastructure, many EVs will be charged at night, at residences, when solar arrays are not generating electricity.

EPA inputs estimate the cost of delivered electricity ($/kWh) as $0.122 in 2021, and $0.133 in 2040. NHTSA inputs estimate the cost of delivered electricity ($/kWh) as $0.121, and $0.120 in 2040. States with a larger percentage of renewable electricity generation typically have end-use rates 1.5 to 2.5 times higher than those assumed by the Agencies, with delivered costs ($/kWh) increasing as more renewable generating capacities are added. (Increases in transmission costs and increases in standby generating costs partially offset or exceed cost reductions of solar and wind generation). As the U.S. electricity generating industry transforms towards renewables, Auto Innovators urges policymakers to consider the possibility that electricity rates may be considerably more expensive relative to gasoline than projected in the GHG NPRM and CAFE NPRM analyses (as indicated by higher electricity rates in states that are already working toward renewable electricity generation), and this could significantly erode projected fuel savings and consumer demand for EVs. As the penetration rate of EVs increases, the projected electricity rates will become an important modeling input for assessing costs, benefits, and consumer adoption of EVs. Auto Innovators encourages policymakers to consider the possibility that electricity rates may double from 2021 to 2040 (in

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[176] Benjamin Kroposki, "Integrated High Levels of Variable Renewable Energy into Electric Power Systems," National Renewable Energy Laboratory (revised Dec. 2018), available at https://www.nrel.gov/docs/fy17osti/68349.pdf (accessed Sep. 24, 2021) at 11.

[177] *State Electricity Profiles*, U.S. Energy Information Administration, https://www.eia.gov/electricity/state/ (accessed Sep. 24, 2021).

[178] *Electric Power Monthly: Table 5.6.A Average Price of Electricity to Ultimate Customers by End-Use Sector*, U.S. Energy Information Administration, https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_5_6_a (accessed Sep. 24, 2021).

[179] *Solar Futures Study*, U.S. Department of Energy Office of Energy Efficiency & Renewable Energy (Sep. 2021), available at https://www.energy.gov/sites/default/files/2021-09/Solar%20Futures%20Study.pdf (accessed Sep. 24, 2021).

2018$ terms) when considering policies for light-duty vehicle GHG and CAFE, and to use real-world data to inform an electricity price forecast.

Both the EPA and NHTSA proposals assume that EVs will be driven like their ICE counterparts, but early data suggest this is not the case. In each agency's analysis, benefits like fuel savings accumulate as miles are driven. The benefits of EVs could be overestimated (perhaps significantly so) if multi-vehicle households shift their mileage towards ICE vehicles and drive the EVs less than projected. The Agencies should review the data used to create vehicle miles traveled (VMT) assumptions, and study how EVs are accumulating miles over time relative to comparable ICE vehicles, and how these differences trend as the market for EVs matures. Coordinated policies and programs (like charging infrastructure) will be important to realize the benefits as projected with the current VMT schedules in the modeling tools, and to entice drivers to choose EVs for all kinds of trips, in all kinds of driving conditions.

Forecasts for Conventional Fuel Prices

Both EPA and NHTSA recognize fuel savings as significant in the benefit-cost analysis. These fuel savings accumulate to consumers based on assumed prices of fuel, fuel efficiency for combinations of technologies, and travel over the lifetime of the vehicle. Each analysis recognizes that independent of regulations, consumers will adopt fuel saving technologies that pay back quickly.[180]

Fuel prices vary significantly across the U.S. California has some of the highest gasoline prices in the country, often 50% higher than in other states with large automotive markets.[181] Many manufacturers' sales vary significantly by region. Some manufacturers have higher sales concentrations in California and Section 177 states than other manufacturers, and this may affect corporate strategy and the incorporation of fuel-saving technologies on vehicles. Auto Innovators encourages policymakers to consider the importance of regional factors carefully before exporting California policy as a baseline for federal standards.

Both the EPA and DOT analysis use—and have used—forecasts from the U.S. Energy Information Administration for fuel prices in their central analyses. Over the last decade (as shown in Figure VII-1), these fuel price forecasts have significantly overestimated the national average price of gasoline, which has in turn overstated the projected benefits of increases in stringency and improving fuel economy for consumers in the near term. Over the last decade, the long-term price outlook for gasoline has steadily declined as well, both in the EIA forecasts, and in private sector forecasts.

Interestingly, NHTSA included a sensitivity case for gasoline prices, as forecast by Global Insight. This is a credible source, alongside the EIA forecast. Both forecasts have a

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[180] Within 30 months, for instance.

[181] *Weekly Retail Gasoline and Diesel Prices*, U.S. Energy Information Administration, https://www.eia.gov/dnav/pet/pet_pri_gnd_a_epmr_pte_dpgal_w.htm (accessed Sep. 24, 2021).

similar trajectory and values from 2022-2029, but they depart significantly in 2030 and beyond. Gasoline prices are volatile, and difficult to predict. Both EPA and NHTSA show U.S. consumption of gasoline decreasing significantly in the long term, as fuel efficiency of light duty vehicles improves in response to stringent alternatives, and as the fleet transitions towards electrification. Auto Innovators encourages policymakers to review the assumptions underlying the EIA gasoline price forecast, including assumed domestic consumption of fuel, and the extent to which plug-in vehicles, meaning BEVs and PHEVs, are assumed to be adopted, and review the extent to which those assumptions are consistent with the policy objectives for light-duty vehicle electrification as stated in recent executive orders. If the EIA Central Case gasoline forecast assumes fewer than 50% plug-in vehicles by 2030, Auto Innovators encourages use of the Global Insight gasoline price forecast in the Central Case for both EPA and NHTSA analysis.

To the extent that gasoline prices may remain low in the long-term (perhaps reflecting depressed demand for gasoline, as shown in both of the Agencies' analysis), consumers may require additional incentives to transition towards plug-in vehicles.

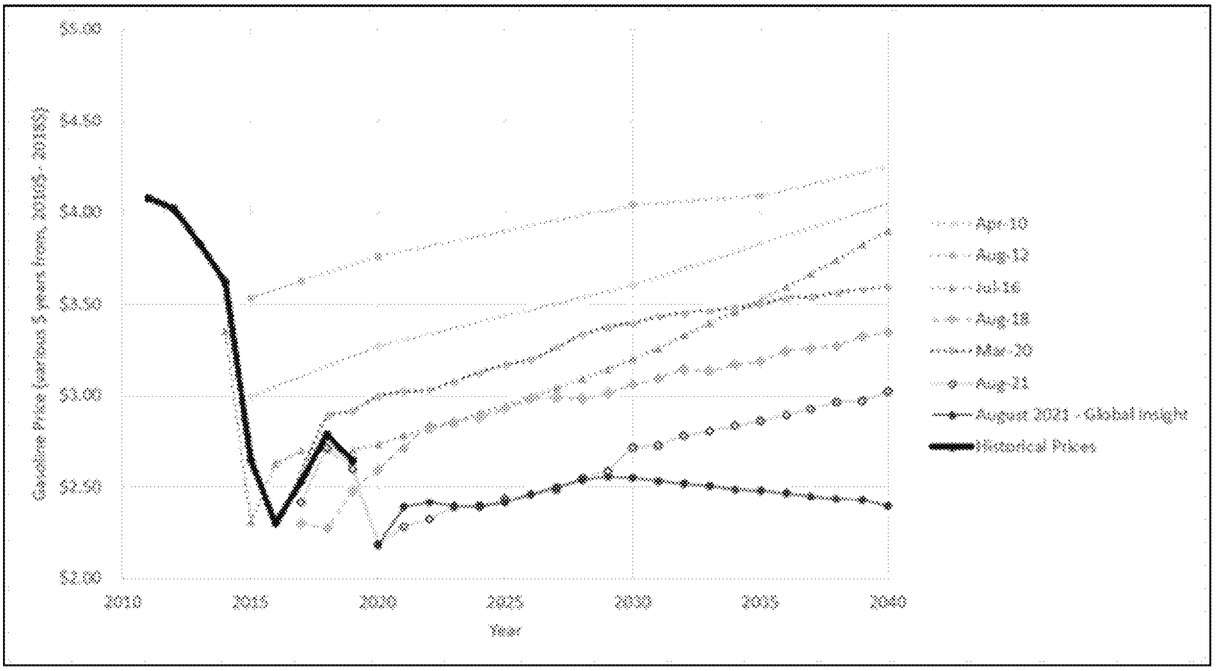

Figure VII-1: Comparison of EIA and Global Insight Gasoline Price Forecasts

Many of the projected benefits of the proposal are backloaded, taking years for consumers, and society, to realize payback on fuel-saving technologies. If gasoline prices do not increase significantly in the 2030 and beyond timeframe, this would have significant bearing on the benefit-cost analysis, and the projected benefits of the proposed rule. Policymakers should carefully consider this possibility given the trends of fuel price forecasts over the last decade, and consumption projections.

GHG Emissions Benefits

From a societal perspective, Auto Innovators believes that GHG control is the most compelling benefit category that supports stricter CAFE and GHG standards.[182] However, the proposed rulemakings do not include recent advances in scientific analysis of the social cost of carbon.[183] We are aware that the Administration intends to update estimates of the social cost of carbon emissions based on new scientific developments. However, before the Agencies consider any changes in the SCC, and we urge the Administration to undertake a rigorous process that includes independent scientific peer review and ample opportunity for public comment.

In reviewing how the SCC was applied in the RIAs, Auto Innovators noticed an inconsistency in how SCC is applied to future benefits and costs. A basic principle of benefit-cost analysis is that the same rate of discount should be applied to any future benefit or cost that is experienced in the same calendar year. However, in some of the analyses reported, the discount rate for a climate-related benefit (in, for example, 2040) is discounted at a smaller rate (*e.g.*, 2.5%) than the discount rates (3% or 7%) applied to local-air quality benefits and energy-security benefits in 2040. There may be a valid rationale for applying a smaller discount rate for long-term climate-related impacts, but coherence demands that the lower rate should be applied to all impacts that occur in those distant years. This discrepancy could be resolved by applying the 2.5% rate only in those years that transcend the analytic time horizon for the other benefit and cost streams (e.g., post-2050 or 2060). Alternatively, if a lower discount rate is applicable after a specific year (say) 2040, when multiple benefit and cost items are affected, then that lower discount rate should apply to all benefit and cost items that occur starting 2040.

One important step to clarifying the confusion is for both RIAs to provide a clear statement of the analytic time horizon for benefit and cost accounting. The RIAs state clearly that model years through 2050 are included in some of the modeling but the year 2050 is not the end of the analytic time horizon. The SCC estimates used by the Agencies presume that a ton of

[182] This is not to say that the Agencies should focus only on GHG benefits and ignore other considerations such as technological feasibility, economic practicability, and appropriate lead-time.

[183] For an introduction to this recent literature, see MG Morgan, P Vaishnav, H Dowlatabadi, IL Azevedo, "Rethinking the Social Cost of Carbon. Issues in Science and Technology," Vol. XXXIII(4) (Summer 2017); Nicholas Stern, Joseph E Stiglitz, "The Social Cost of Carbon, Risk, Distribution, Market Failures: An Alternative Approach," NBER Working Paper 28472 (Feb. 2021), DOI 10.3386/w28472; Nicholas Stern, Joseph E Stiglitz, "Getting the Social Cost of Carbon Right," (Feb. 15, 2021), project-syndicate.org; Justin Gundlach, Peter Howard, "Improve the Social Cost of Carbon, Do Not Replace It. The Regulatory Review," (Apr. 12, 2021); Joseph Aldy, Matthew J Kotchen, Robert N Stavins, James H Stock, "Keep Climate Policy Focused on the Social Cost of Carbon," Science, 373(6557), (Aug. 20, 2021), 850-852; Gernot Wagner *et al.*, "Recalculate the Social Cost of Carbon," Nature Climate Change, 11, (2021), 293-294; and Jarmo S Kikstra et al., "The Social Cost of Carbon Dioxide Under Climate-Economy Feedbacks and Temperature Variability," Environmental Research Letters, 16(9), (2021), 094037.

CO2 emitted in 2020 can have welfare impacts far into the future, as IPCC estimates that most released CO2 remains in the atmosphere between 5 and 200 years.[184]

Thus, the reader needs to know how long the analytic time horizon is, and what procedures for discounting are employed throughout the time horizon. Publishing the undiscounted time streams for each benefit and cost category as an appendix to the RIA would allow readers to perform their own sensitivity analyses with different rates. Whatever decision is made, benefit and cost impacts in the same calendar year should be subjected to the same discount factor.

Local Air Quality Benefits

Both RIAs examine the possible impact of revised standards on local air quality, with an emphasis on public health impacts of exposures to PM2.5. On a quantitative basis, the local air-quality benefits do not play a major role in either RIA compared to the private fuel savings and climate benefits. Nevertheless, Auto Innovators suggests that the technical quality of the air-quality benefits analyses can be improved.

In its use of the GREET model to estimate PM2.5 benefits from reduced upstream petroleum-sector sources, both Agencies appear to be assuming that a decrease in gasoline consumption in the U.S. will lead to a proportional decrease in the amount of upstream emissions during oil production, transportation and refining in the U.S. Without those decreases, there is no basis for assuming a reduction in PM2.5 emissions throughout the U.S. petroleum supply chain. However, in the energy-security benefits analysis (discussed below), the Agencies assume that over 90% of the petroleum impact of the proposed rules will occur in the form of reduced oil imports rather than reduced production of oil in the U.S. Moreover, the energy-security analyses in the RIAs and in the NHTSA TSD argue that the U.S. refinery sector will not be impacted significantly by a modest decline in U.S. gasoline consumption, since the U.S. refinery sector has opportunities to expand the export of refined products around the world. If the agencies maintain these energy security assumptions for the final rule, they cannot logically assume upstream PM 2.5 control benefits in the U.S. If the Agencies forecast PM2.5 health benefits outside the U.S. (*e.g.*, from reduced production, transport and refining of petroleum elsewhere in the world), those health benefits should be based on applicable dose-response and valuation data and be reported separately as suggested in OMB Circular A-4.

Auto Innovators also noticed that there are large variations in the ratio of climate-related benefits to air-quality benefits in the two RIAs and in the peer-reviewed scientific literature. As a quality-control check, Auto Innovators recommends that the Agencies compare the four different studies below (Table VII-1) and isolate the major factors that explain the huge variation in the ratio of climate benefits to local air-quality benefits. In the process of performing this comparison, the Agencies may learn about analytic inputs or procedures that can be updated or harmonized to reduce the huge variation. The Agencies should certainly explain the eight-fold difference in their own estimates of the ratio. Moreover, the Agencies

[184] IPCC, Working Group I: The Scientific Basis, Archive.ipcc.ch, Table 1 (accessed Oct. 4, 2021).

might present some additional sensitivity analyses to reveal how the ratio of climate benefits to air-quality benefits might vary under alternative yet plausible assumptions. Each entry in the table below is based on a 3% discount rate, so differences in the discount rate should not be contributing to the huge variation. Factors to investigate are the tailpipe emissions rates of PM2.5 and its precursors for the relevant model years, rebound rates, upstream emissions from electric power plants due to the charging of BEVs, emissions during the manufacturing of BEVs and batteries, PM2.5 dose-response assumptions, the Social Cost of Carbon and value of a statistical life ("VSL") values.

Table VII-1: Ratio of Climate Benefits to Air Quality Benefits in the RIAs and in Selected Studies in the Peer Reviewed Scientific Literature

Study	Ratio of Climate to Air Quality Benefits
NHTSA RIA (2021)	80 [185]
EPA RIA (2021)	10.3 [186]
Choma, et al. (2020)	0.2 [187]
Tong and Azevedo (2020)	Climate Benefits > 0; Air Quality Benefits < 0 [188]

Neither the two RIAs nor the two cited scientific papers include some important reasons for giving less weight to local air quality as a rationale for the revised standards. We summarize those reasons below and encourage the Agencies to address them.

First, any net reductions in PM2.5 emissions (primary or PM2.5 precursors) accomplished by the revised standards will not provide public health benefits that are additive to the emissions reductions accomplished by EPA's mobile-source and stationary-source programs for criteria air pollutants. The public health benefits are not additive, as we explain below, because of the way Congress designed the Clean Air Act and the way EPA defines emissions limits and non-attainment on a community-by-community basis.

Insofar as the revised standards cause a reduction in engine-out emissions due to less combustion of gasoline, the amount of tailpipe emissions will not decline proportionately. The

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185 CAFE NPRM (*supra* note 2) at 49720. (Table III-37; 32.0 / 0.4 = 80.0.)

186 GHG NPRM (*supra* note 2) at 43795. (Tables 54 and 55; 91 / 8.8 = 10.3.)

187 EF Choma, JS Evans, JK Hammitt, JA Gomez-Ibanez, "Assessing the Health Impacts of Electric Vehicles through Air Pollution in the United States," Environmental International, 144 (Nov. 2020), 10082: 106015, especially at 6. (3% discount rate applied to cessation lag only. Air quality benefits of EVs are "five times" climate benefits, given standard value for social cost of carbon.)

188 Fan Tong, Ines ML Azevedo, "What Are the Best Combinations of Fuel-Vehicle Technologies to Mitigate Climate Change and Air Pollution Effects Across the US?," Environmental Research Letters, 15 (2020), 074046, esp. Table 3 at 6 (cars). ((1.25-0.78) – (0.65 – 0.91)/ (0.65 – 0.91). Numerator is positive; denominator is negative, which is why the authors emphasize the importance of cleaning up the grid for EVs to contribute to local air quality.)

structure of the Clean Air Act and the EPA/CARB regulations define limits on tailpipe emissions of criteria air pollutants in terms of grams of pollution per mile. Vehicle manufacturers and their suppliers seek to fully comply with those standards on a least cost basis, since any unrequired expenditures on emissions control could place an individual vehicle manufacturer or supplier at a competitive disadvantage. If engine-out emissions are reduced due to the revised CAFE/GHG standards, vehicle manufacturers can adjust the design of their catalyst systems to reduce compliance costs while maintaining compliance with the gram-per mile standards. One way vehicle manufacturers and suppliers do this is by reducing the use of expensive coatings on the catalyst. Thus, from a technical point of view, the benefits of reduced engine-out emissions are not experienced in public health terms but in savings to manufacturers/suppliers and consumers in the costs of emissions control. Insofar as the Agencies seek to claim benefits from reduce engine-out emissions (due to greater fuel economy), they should estimate the savings in catalyst costs that result. While complex catalyst systems can add $200 to $400 to the cost of manufacturing a new vehicle, the incremental cost savings from the changes in coatings to catalysts will be only a small fraction of the total cost of the system. For the entire fleet, those savings will be a small fraction of the purported public health benefits that are currently claimed in the RIAs.

Second, reductions in vehicle emissions do not provide additive benefits to public health because of the structure of the Clean Air Act, which allow the states to include national changes in mobile source emissions in their state emissions inventories and implementation plans for attainment of the National Ambient Air Quality Standards. In nonattainment areas and areas close to nonattainment, states and localities are disinclined to impose any more limits on stationary source emissions than is necessary to meet EPA's air-quality standards. If state and local limits are unduly strict, new factories may be built in other states and localities where the state implementation plans are not as strict on new stationary sources. (In attainment areas, where PM2.5 health benefits might also be considered, there is the complication of the PSD doctrine that needs to be evaluated). Thus, the practical impact of diminished mobile source emissions, at the margin, is somewhat less pressure on stationary sources to meet the requirements described in state implementation plans. Thus, there are benefits from further reductions in mobile source emissions, but they are likely to be realized in reduced compliance costs for stationary sources rather than as public health benefits from reduced overall exposures to PM2.5. The magnitude of the compliance cost savings is likely to be a small fraction of the estimated public health benefits, given EPA estimates that the benefits of PM control vastly exceed costs in the stationary source arena.

Finally, insofar as residual emissions of criteria or toxic air pollutants are seen as a rationale for the revised standards or for the transition to BEVs, the Agencies should consider some possible alternative policies to accomplish those benefits that might be more effective and cost effective than stricter CAFE/GHG standards or BEVs. Examples of such measures include tighter tailpipe standards for PM-related pollutants, (indeed, CARB has already proposed tighter particulate limits, and EPA has announced interest in a new rulemaking in this area) and improvements to gasoline. The incremental air-quality benefits of BEVs would be diminished significantly as EPA and CARB took further steps to control PM from mobile sources.

Regarding uncertainty analysis, EPA and NHTSA are using simplified benefit per ton multipliers for PM2.5 emissions without including sensitivity analysis of each of the key inputs identified by the EPA Science Advisory Board ("SAB"). SAB recommended sensitivity analyses of alternative values of the dose-response function, differential toxicity by type of particle, and spatially-dependent VSL values.[189]

Considering the above, the agencies should re-evaluate the public health benefits related to local air quality.

Energy Security Benefits

Auto Innovators agrees with the thrust of the RIAs that energy-security benefits are a less compelling rationale for the proposed standards and (for the transition to EVs) than they were when the CAFE program was created in 1975, and even when the Obama-era standards were finalized in 2012. Due to the post-2014 success of unconventional oil-development technologies ("fracking"), the U.S. is now a net exporter of oil and the new fracking developers have demonstrated their ability to weaken the pricing power of the OPEC cartel. Despite the relatively recent uptick in global oil prices in 2021, EIA's long-term forecasts of world oil prices are much lower now than they were in 2012.

Moreover, the U.S. is no longer the dominant contributor to world oil consumption. The US share of global oil consumption declined from about 33% in 1974 to about 20% in 2020. EIA does forecast increasing global demand for oil by 2025 but most of the growth is accounted for by China, India, and other developing economies. Thus, the U.S. share of global oil demand will likely continue to decline over the course of the rulemaking analysis period.

Auto Innovators did notice some subtle inconsistencies in how the Agencies analyzed energy-security benefits. EPA appears to focus on a predicted decline in imports of oil into the U.S. whereas NHTSA appears to focus on a diminished vulnerability of the US economy to an oil supply interruption (which relates more to the oil-intensity of the U.S. economy rather than oil imports, per se).

Auto Innovators is not fully convinced that a decrease in U.S. gasoline consumption will impact oil imports to the U.S. rather than U.S. oil producers and refiners. While this assumption may have been valid decades ago when the first CAFE standards were issued and when the U.S. relied substantially on OPEC countries for imports, it is a less valid assumption today. Canada is now the largest source of U.S. oil imports, accounting for 52% of U.S. total gross petroleum imports and 61% of gross crude oil imports. Mexico is the second largest source of U.S. oil imports, accounting for 11% of US imports. OPEC countries now account for less than 10% of U.S. oil imports.[190] In some cases, those OPEC imports to the U.S. represent OPEC use of U.S.

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[189] *Review of EPA's Reduced Form Tools Evaluation*, EPA Science Advisory Board (Dec. 2020).

[190] *Oil and Petroleum Products Explained: Oil Imports and Exports*, Energy Information Administration, Eia.gov, (accessed Sep. 29, 2021).

oil refining capacity, since some OPEC countries do not have sufficient refining capability. The refined petroleum products provided by U.S. refiners may then be exported by OPEC countries around the world rather than be used to meet U.S. needs. Thus, some of the relatively small volumes of OPEC imports to the U.S. are likely to be unaffected by the stringency of U.S. GHG and CAFE standards. More importantly, GHG and CAFE standards seem unlikely to have any meaningful impact on imports from Canada and Mexico because U.S. buyers can obtain good prices, secure supplies, and/or long-term contracts from Canadian and Mexican producers. Since oil is produced, refined and sold in a global marketplace, the Agencies should provide a rigorous analysis of which oil producers/refiners in the world will be adversely impacted by an incremental decline in U.S. demand for oil. This issue will be even more important in future rulemakings insofar as the agencies estimate much larger reductions in gasoline consumption.

Comments on Analysis of Costs

Rebound Effects

The RIAs recognize that some consumers may respond to the lower-operating costs of fuel-efficient vehicles by increasing their amount of vehicle travel. The Agencies wisely take a sensitivity-analysis approach to the magnitude of this effect, since rebound effects are difficult to estimate with a high degree of precision.

The Agencies have not yet incorporated another type of rebound effect, sometimes called “attribute substitution”, which occurs at the vehicle purchasing stage and may also occur when households make decisions about which vehicles to use on trips (e.g., urban versus rural trips, and short trips versus long trips).

Some balancing of vehicle attributes occurs in households without any regulatory inducement. If a household owns a relatively fuel-efficient small car, they may be inclined to purchase a minivan or large SUV as their second vehicle. In Norway, households with a fully battery-operated electric vehicle – the dominant propulsion system in the market -- sometimes purchase a luxurious diesel-powered car or a premium PHEV as their second vehicle.[191]

As emerging economics literature suggests that attribute substitution could somewhat diminish the effectiveness and cost-effectiveness of NHTSA’s CAFE standards, EPA’s GHG standards and other policies aimed at boosting the fuel economy of the new-vehicle fleet.[192] When regulations induce households to own a more fuel-efficient vehicle or an advanced technology vehicle, households may choose to “trade” (balance) some of the enhanced fuel economy in their new vehicle for more performance, safety, seating space, cargo space or towing capability in their next vehicle purchase. This “attribute” substitution occurs in multi-

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[191] N Wakamori, “Portfolio Considerations in Differentiated Product Purchases: An Application to the Japanese Automobile Market,” University of Mannheim Discussion Paper SFB/TR15, No. 499 (2019).

[192] Jim Archsmith, Ken Gillingham, Chris Knittel, Dave Rapson, “Attribute Substitution in Household Vehicle Portfolios,” RAND Journal of Economics, 51(4) (2020) at 1162-1196.

vehicle households, which account for about 75% of the households that purchase new passenger vehicles in the US.

In a long-term setting where all vehicle types are becoming more fuel efficient, the magnitude of attribute-substitution effects is attenuated. However, the U.S. faces at least a 15-year transition process, but possibly as much as 30-year, where households will be owning at least one electric vehicle and at least one internal combustion engine vehicle that could range from a small car to a pickup truck or large SUV.

Attribute substitution can also occur when households make decisions about which vehicle to use for specific trips.[193] The Agencies' RIAs make the implicit assumption that VMT by new gasoline-powered cars will be replaced, one to one, by VMT in new electric vehicles. In Norway, however, some households supplemented – rather than replaced – their ICE vehicles with electric vehicles. Both vehicles were used with intensity, and some uses of public transit declined.[194] Thus, attribute substitution for specific trips is a complex process that the Agencies should model to supply accurate estimates of how much GHG control is accomplished during the transition to an EV-dominated fleet. Insofar as the EV transition contributes to more congested traffic in urban areas (e.g., as BEV trips substitute for public-transit trips, biking and walking), the RIAs should acknowledge this effect and quantify the ramifications for commuter travel times and other adverse effects of congestion.[195]

One of the rationales for comprehensive modeling of rebound effects is that such modeling underscores the importance of complementary and supporting policies during the transition to BEVs.

<u>Costs of Battery Electric Vehicles</u>

Both RIAs simulate a significant increase in BEV penetration under the revised standards. It is important that the Agencies use plausible estimates of the future costs of electric vehicles.

A crucial assumption of the agency analyses of BEVs is that the manufacturing cost of a BEV declines in the decade ahead due to a continued decline in the cost of producing battery packs and other components of BEVs. A recent study covering 1992 to 2016 found that the real price of lithium-ion battery packs did decline an average of 13% per year when measured according to energy capacity supplied. When energy-density improvements are considered, the

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[193] DeBorger, I Mulalic, J Rouwendal, "Substitution Between Cars within the Household," Transportation Research Part A, 85 (2016) at 135-156.

[194] Bjorn Gjerde Johansen, Anders Munk-Nielson, "Portfolio Complementarities and Vehicle Adoption," Working Paper (2021), https://www.dropbox.com/s/tyk/8qwq65buc8i/two-car-submission2.pdf?dl=0.

[195] Bjart Holtsmark, Anders Skomhoft, "The Norwegian Support and Subsidy Policy of Electric Cars. Should it Be Adopted by Other Countries?," Environmental Science and Policy, 42 (2014) at 160-168.

annual improvement rate was about 17%.[196] Bloomberg New Energy Finance ("Bloomberg NEF") bases its battery-price forecasts on a historical annual learning rate of 18% and aggressive demand forecasts for EVs and lithium-ion batteries (which leads to high production volumes and associated efficiencies). Bloomberg NEF also assumes that battery producers can achieve maximum economies of scale by producing packs for both the stationary energy storage market as well as for EVs. Recently, the Bloomberg NEF annual battery-pack price survey found that prices continued to fall 13% from 2019 to 2020, a period when raw material prices for battery cells were falling due to the EV sales slowdown in China.[197] The National Academies ("NAS") acknowledges that, in recent years, the sharp decline in material costs for cathodes was due primarily to a corresponding decline in the constituent metal prices, a trend that "may not be sustainable."[198]

The traditional method of accounting for possible future changes in battery-pack costs is to apply a learning curve in future years based on production volume, and then make a somewhat arbitrary assumption about when the rate of decline decelerates or stops (technological maturity). NAS did not forecast changes in material prices but nonetheless assumed that pack costs will decline by a rate of 7% per year until 2030.[199] EPA did not change battery-cost estimates compared to the final SAFE rule but opined they may be too high without explanation.[200] NHTSA, in its RIA, assumes production-volume economies will reduce NMC 822 production costs by up to 8% in the near-term but by less than 1.2% after seven years.[201]

The underlying literature focuses on learning related to volume of production, but the Agencies and NAS compress numerous unanalyzed issues into a "learning factor". NHTSA, for example, in the SAFE Rule analysis of battery costs[202] – which is the basis for NHTSA's current battery-cost analysis – acknowledges that the learning factor is intended as a "proxy" for changes in battery chemistry, changes in energy density, further gains in plant efficiency, and additional economies of scale in production due to higher production volumes.

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[196] MS Ziegler, JE Trancik, "Re-Examining Rates of Lithium-Ion Battery Technology Improvements and Cost Declines," Energy and Environmental Science (2021) at 4.

[197] "Battery Pack Prices Cited Below $100/kWh for the First Time in 2020, While Market Average Sits at $137/kWh," Bloomberg New Energy Finance (Dec. 16, 2020).

[198] *2021 NAS Report* (*supra* note 37) at 5-96.

[199] *Id.* at 5-142 (Finding 5.16).

[200] *EPA RIA* (*supra* note 171) at 4-4.

[201] *CAFE TSD* (*supra* note 76) at 287 (Table 3-77, NMC 622).

[202] *Final Regulatory Impact Analysis: The Safer Affordable Fuel-Efficient Vehicles Rule for Model Year 2021-2026 Passenger Cars and Light* Trucks, National Highway Traffic Safety Administration and U.S. Environmental Protection Agency (Mar. 2020) at 656 and 680.

All unanalyzed factors are seen as contributing to future reductions in battery-pack costs; neither NAS nor the Agencies confront the real possibility that counteracting, unanalyzed factors could work to restrain the future decline in battery-pack costs.

A recent MIT report took an important step toward realistic forecasting by simulating future battery-pack costs using a two-stage model: one stage for the costs of materials, including processing and synthesis, and a second stage for the costs of manufacturing battery packs.[203]

MIT's second stage (manufacturing) has annual cost declines of 16.5% (+/- 4.5%) per year – like the results of one-stage models – but the first stage on material inputs (including materials synthesis) declines at only 3.5% per year. Obviously, the raw material costs provide a floor on the future costs of battery packs. Even assuming NMC 811 is the dominant battery chemistry in 2030 (which ensures lower material costs due to substitution of nickel for costly cobalt), the simulated pack-level costs in 2030 are not sufficiently low in the MIT two-stage simulation to hit DOE's target of $100 per kWh. In fact, the DOE goal of $100 per kWh by 2030 cannot be met unless material prices remain depressed at 2016 levels.[204]

NHTSA erroneously refers to the battery-cost estimate from the MIT simulation as an "upper bound";[205] in fact, the MIT report supplies both a best estimate and upper and lower cost estimates based on different scenarios with the two-stage model (best estimate of $124/kWh, low estimate of $93/kWh; high estimate of $140/kWh). The two-stage model used by the MIT Energy Initiative is based on peer-reviewed scientific modeling but without recent information (2021) on the resurgence of material prices.[206] The Agencies have not yet performed an in-depth analysis of material costs for lithium-ion batteries; indeed, NHTSA acknowledges that it has performed no analysis of future prices of raw materials.[207] Current sensitivity cases on the learning rate alone are insufficient. The Agencies should work with National Laboratories, DOE, and others to produce sensitivity cases for raw and processed material costs, material efficiency in battery construction, and other considerations.

To provide proper analysis of the penetration of different battery chemistries, Auto Innovators recommends that the Agencies remove changes in battery chemistry from the near-term learning factor (2021-2032) and analyze it separately and explicitly in the RIAs. The

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[203] *Insights into Future Mobility* (*supra* note 32).

[204] IL Hsieh, SP Manghsuao, YM Chaing, WH Green, "Learning Only Buys You So Much: Practical Limits on Battery Price Reduction," Applied Energy, 239 (Apr. 2019) at 218-224.

[205] CAFE NPRM (*supra* note 2) at 49684.

[206] IL Hsieh, SP Manghsuao, YM Chaing, WH Green, "Learning Only Buys You So Much: Practical Limits on Battery Price Reduction," Applied Energy, 239 (Apr. 2019) at 218-224.

[207] CAFE NPRM (*supra* note 2) at 49684 (footnote 292); *CAFE TSD* (*supra* note 18) at 283.

proposed NHTSA RIA assumes that one battery chemistry (NMC 622) is representative of the industry for BEVs, as it was the most common cathode chemistry in 2019.[208] Instead of choosing one battery chemistry as representative of the entire industry, as the Agencies do with the Argonne battery model, the Agencies should forecast the penetration of different battery chemistries in the fleet from 2021 to 2032 and estimate applicable costs for each of them. Since alternatives to lithium-ion batteries are unlikely to have significant penetration prior to 2032, the relevant battery designs for 2021-2032 are the five discussed below (NCA, NMC 111, NMC 622, NMC 811, LFP). Those batteries are well enough understood to perform separate cost analyses for each, rather than assume an arbitrary learning curve. The learning curve should focus on production volume and cell yield rather than battery chemistry.

Auto Innovators is also supplying some detailed information and analytic guidance on several other unanalyzed factors that might restrain the future rate of decline in BEV costs. We encourage the agencies to account for these factors as they make forecasts of future production costs of BEVs.

Battery Raw Material Price Impacts and Considerations

Raw material prices can greatly impact the costs of producing electric vehicles. The Agencies should adopt or develop a two-stage learning model for battery costs that accounts for both raw material costs and other volume/time-based learning in place of the single stage learning curve used in the Agencies proposals.

The key raw materials for battery packs are lithium, cobalt, nickel, manganese and natural graphite. The rare earth neodymium is critical for electric motors.[209]

Could EV producers face rising raw material prices between today and 2032? It is certainly possible. In the first seven months of 2021 alone, the surge in demand for EVs in China, Europe and the U.S. has induced a rapid recovery in depressed material prices. From January 1, 2021, to July 1, 2021, the spot prices for lithium, cobalt, nickel, manganese, natural graphite, and neodymium have changed +91.4%, +63.1%, +15.0%, +10.4%, +32%, and +24.9%, respectively.[210] Some of this surge reflects global recovery from the COVID-induced recession.

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[208] CAFE NPRM (*supra* note 2) at 49682.

[209] Sarah Scott, Robert Ireland, "Lithium-Ion Battery Materials for Electric Vehicles and their Global Value Chains," Office of Industries Working Paper ID-068, U.S. International Trade Commission (Jun. 2020).

[210] Bonnen Battery, "Is Lithium Battery Price Likely to Become More Expensive in 2022?," www.bannenbatteries.com (Aug. 23, 2021); Yoke Wong, "Nickel Forecast: Will the Metal Surge Past $20,000?," Capital.com (Sep. 1, 2021); Manganese Ore, 2021 prices, tradingeconomics.com (accessed Sep. 30, 2021); Suzanne Shaw, "Graphite: Amorphous Prices Continue to Rise," Roskill.com (Jul. 23, 2021); Neodymium, Tradingeconomics.com, (accessed Sep. 30, 2021).

Less than a handful of the dozens of published battery-forecasting models include any formal analysis of global trends in raw material prices.[211] None of the published battery-forecasting models have accounted for the surge in material price experienced in 2021.[212]

The Agencies are currently relying on the Battery Performance and Cost Model ("BatPaC") developed by Argonne National Laboratory. This transparent spreadsheet model provides a peer-reviewed, bottom-up approach to account for cost-input factors. However, BatPaC does not include a formal global model of the market for each raw material used in battery packs. Instead, "the price of raw materials is based on our best estimate at the time of version release".[213] No analytic detail is provided to support the best estimate. The versions used by the Agencies does not account for the 2021 surge in raw material prices.

Gauging the impact of raw material prices on the costs of BEVs requires the following information:

- Material intensities of the raw materials in the cathode chemistry (defined as kg/kWh). These intensities were obtained from reprinted Table 3 (Figure VII-1, below) for several of the cathode chemistries (NCA, NMC 111, NMC 622, NMC 811, LFP).
- Raw material prices.
- Derivation of the weights of the materials used as a fraction of the raw materials provided (e.g., lithium as a percentage of lithium carbonate, neodymium as a percentage of neodymium oxide).

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[211] Lukas Mauler, Fabian Duffner, Wolfgang G Zeier, Jens Leker, "Battery Cost Forecasting: A Review of Methods and Results with an Outlook to 2050," Energy and Environmental Science, 14 (2021) at 4712-4739.

[212] Annie Lee, "Lithium Jumps Again as Miners Can't Keep Up with Battery Boom," Yahoo.com (Oct. 5, 2021).

[213] Argonne, BatPac Model Model Software, Anl.gov (accessed Sep. 20, 2021).

Table 3: Material intensity of key cathode chemistries (kg/kWh)

	Lithium	Nickel	Cobalt	Manganese
NCA	0.10	0.67	0.13	0.00
NMC 111	0.15	0.40	0.40	0.37
NMC 622	0.13	0.61	0.19	0.20
NMC 811	0.11	0.75	0.09	0.09
LFP	0.10			

Source: Global EV Outlook 2018 (Table 6,1); Argonne Battery Cost Model

Figure VII-2: Material intensities of Raw Materials in Cathode Chemistry. Source: Faraday Insights, https://faraday.ac.uk/wp-content/uploads/2020/12/Faraday_Insights_6_Updated_Dec2020.pdf (accessed Sep. 24, 2021).

The summary tables below show the material costs for lithium, cobalt and nickel for three types of batteries: NMC 111, NMC 622 and NMC 811. For LFP battery chemistry, the usage of cobalt and nickel is zero. The summary tables also show the percent increase in battery cost if the raw material costs were doubled. The Agencies are encouraged to perform similar analyses for manganese and natural graphite.

Table VII-2: Impact of Doubling Raw Material Costs for NMC 111 Chemistry Batteries

Metal	Spot Price – March 2021	Spot Price - Normalized	kg/kWh	Approximate Cost per 64 kWh battery	% Increase if cost doubled [/1]
Lithium (Li_2CO_3)	$16,000/ton	$7.26/lb [/2]	0.15	$826 [/3 /4]	10.3%
Cobalt	$22/lb	$22.00/lb	0.40	$1,239 [/5]	15.5%
Nickel	$7.30/lb	$7.30/lb	0.40	$411	5.1%

Metric ton = 2,205 lbs

[/1] Increase over assumed battery cost for 2021 = 64 kWh x $125/kWh = $8,000

[/2] $16,000/ton x ton / 1000 kg x kg / 2.2 lbs = $7.26/lb

[/3] Lithium is 18.6% of lithium carbonate (Li_2CO_3). (Li x 2 x 6.9 = 13.8; C x 12 = 12; O x 3 x 16 = 48; 13.8 + 12 + 48 = 73.8; 13.8 / 73.8 = 18.6%.)

[/4] $7.26/lb x2.2 lbs/kg x 1 Li2CO3/0.186 Li x 0.15 kg/kWh x 64 kWh = $826

[/5] $22/lb x 2.2 lb/kg x 0.40 kg/kWh x 64 kWh = $1,239

Table VII-3: Impact of Doubling Raw Material Costs for NMC 622 Chemistry Batteries

Metal	Spot Price – March 2021	Spot Price - Normalized	kg/kWh	Approximate Cost per 64 kWh battery	% Increase if cost doubled [/1]
Lithium (Li2CO3)	$16,000/ton	$7.26/lb	0.13	$714	8.9%
Cobalt	$22/lb	$22.00/lb	0.19	$588	7.3%
Nickel	$7.30/lb	$7.30/lb	0.61	$627	7.8%

Metric ton = 2,205 lb
[/1] Increase over assumed battery cost = 64 kWh x $125/kWh = $8,000

Table VII-4: Impact of Doubling Raw Material Costs for NMC 811 Chemistry Batteries

Metal	Spot Price – March 2021	Spot Price - Normalized	kg/kWh	Approximate Cost per 64 kWh battery	% Increase if cost doubled [/1]
Lithium (Li2CO3)	$16,000/ton	$7.26/lb	0.11	$604	7.6%
Cobalt	$22/lb	$22.00/lb	0.09	$185	2.3%
Nickel	$7.30/lb	$7.30/lb	0.75	$770	9.6%

Metric ton = 2,205 lb
[/1] Increase over assumed battery cost = 64 kWh x $125/kWh = $8,000.

The amount of rare earth neodymium used in permanent magnet motors was assumed to be 3.5 kgs. The summary table below shows the percent increase in electric motor cost if the raw material cost of neodymium oxide were doubled.

Table VII-5: Impact on Electric Motor Cost if Raw Material Cost of Neodymium Oxide Were Doubled

Metal	Spot Price – March 2021	Spot Price - Normalized	Weight, lbs	Cost Per Vehicle	% Increase if cost doubled [/2]
Neodymium Oxide	$70,000/mt	$31.82/lb	7.7 lbs (3.5 kg) Nd	$285 [/1 /2 /3 /4]	26% [/5]

Metric ton = 2,205 lbs
/1 Average cost of neodymium per vehicle is $300, Ref: Reuters, https://www.reuters.com/business/autos-transportation/china-frictions-steer-electric-automakers-away-rare-earth-magnets-2021-07-19/, Accessed 9/24/21.
/2 The average electric vehicle uses between 2 and 5 kg of rare earth magnets. Ref: Bunting, https://www.bunting-berkhamsted.com/rare-earth-magnets-in-electric-vehicle-motors/, Accessed 9/25/21.
/3 Neodymuim is 86% of neodymium oxide (Nd_2O_3). Nd x 2 x 144 = 288; O x 3 x 16 = 48; 288 + 16 = 336, 288/336 = 86%.
/4 7.7 lbs Nd x 1 Nd_2O_3/0.86 Nd x $31.82/lb = $285.
/5 Increase over cost of electric motor (electric drive module) of approximatly $1,100: 27%.
Ref. Nic Lutsey and Michael Nicholas, Update on electric vehicle costs in the United States through 2030, ICCT, April 2, 2019.

In summary, a pre-2032 doubling of raw material prices could substantially erode the "learning-curve" cost-reductions assumed in the RIAs. The RIAs do include a helpful sensitivity analysis that varies the learning curve by +-20% and the battery-back costs by +/-20%. But this range is not large enough to account for large increases in raw material prices, especially since the prices of several raw materials could rise simultaneously. There is no basis for believing that raw material prices will decline for a sustained period prior to 2032.

Much more careful analysis of raw material prices is necessary in the final RIAs, because 70% of battery-cell costs are material costs (mostly for the cathode followed by the anode, and then the separator). About 50% of the cathode costs are the constituent costs of raw materials, which makes cathode production costs especially sensitive to raw material prices.[214] NAS notes that the declines in metal prices from 2011 to 2017 that helped drive down material costs "may not be sustainable."[215] The preliminary material price data for 2021 supports NAS's cautionary statement. Over time, as EV manufacturing economics take hold, raw materials – and their prices – will account for an increasing share of the overall cost of battery packs.[216]

The path of raw material prices from 2021 to 2032 (and beyond) will depend critically on how quickly the global supply of raw materials responds to the growth in EV sales and the price signals in the global market.[217] The prospects for each raw material are somewhat different but there are reasons to believe the the global supply responses will be sluggish, especially from 2021 to 2032.[218] Major advances in battery design, which could overwhelm the impact of raw material prices, are more likely to exert their impact from 2030 to 2050 than from 2021 to 2030.[219] Each of the key raw materials is considered below.

Lithium

The earth has plenty of lithium resources, and the recoverable reserves are more than adequate to support a massive expansion of the global electric vehicle sector. The practical limits on lithium development are more binding than the physical limits on resources.

Lithium mining requires substantial volumes of water but over 50% of lithium mining occurs in water-stressed areas.[220] The energy requirements are also substantial, but promising reserves are often located in areas with little or no energy infrastructure. And lithium miners

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[214] Marc Wentker, Matthew Greenwood, Jens Leker, "A Bottom-Up Approach to LIB Cost with a Focus on Cathode Active Materials," Energies, 12(3) (2019) at 504.

[215] *2021 NAS Report* (*supra* note 37) at 5-96.

[216] Marcelo Azeuedo, Nicolo Campagnol, Toralf Hagenbruch, Ken Hoffman, Ajay Lala, Oliver Ramsbottom, "Lithium and Cobalt: A Tale of Two Commodities," McKinsey and Company (Jun. 2018).

[217] Gunther Martin, L Rentsch, M Hock, M Bertau, "Lithium Market Research – Global Supply, Future Demand, and Price Development," Energy Storage Materials, 6 (2017) at 171-179.

[218] John D. Graham, *The Global Rise of the Modern Plug-In Electric Vehicle: Public Policy, Innovation, and Strategy*, Elgar Publishing, United Kingdom (2021), Chapter 7 ("Securing Raw Materials") at 285-321.

[219] Lukas Mauler, Fabian Duffner, Wolfgang G Zeier, Jans Leker, "Battery Cost Forecasting: A Review of Methods and Results with an Outllook to 2050," Energy and Environmental Science, 14 (2021) at 1754-5692.

[220] *The Role of Critical Minerals in the Clean Energy Transition,* International Energy Agency (May 2021).

need good access to ports with sea-faring capability in order to ship lithium compounds to refineries for processing, prior to their use in cathode production.

Opposition to lithium mining and processing – among both organized environmental groups and local communities – is intensifying in many parts of the world (including the US). Such opposition lengthens the historically long time frames for lithium development projects (about five years in Australia and seven years in South America, based on 35 projects that came on line between 2009 and 2019).[221] In countries with little or no experience with lithium mining, project time lines are much longer, an average of 16 years to move from discovery to first production.[222] The opposition is understandable because both lithium mining and processing have significant ecological footprints (some temporary, others longer lasting). In some cases, lithium development may also create conflicts with other business sectors such as tourism, ranching, and agriculture. In addition, investors are hesitant to make new commitments to lithium mines because of the historical price volatility and the low prices contained in some long-term projects negotatied when global prices were depressed from 2018-2020.[223]

Analysts from Roskell project that, due to rising sales of electric vehicles, the global demand for lithium will rise by a factor of 4.5 between 2020 and 2030. Since supplies are expanding slowly, global supply deficits of lithium are projected toward the end of 2021 and 2022. Without successful new lithium mines, supply deficits will extend until 2030 or later. Even with new lithium mines, prices will rise insofar as the marginal cost of lithium from new mines is larger than the marginal cost of lithium from existing mines. Thus, all signs point to increasing lithium prices, at least until (or if) post-2030 lithium-free battery technologies emerge as viable substitutes for lithium ion batteries.[224]

Here is a brief status report on lithium development around the world, with an indication of whether significant local opposition has emerged and/or delays have occurred. The importance of lithium processing capability (as well as mining) is emphasized.

1. Sonora Lithium Project, Mexico. Bacaonora Lithium (UK), owned 50% by Ganfeng Lithium (China), is developing a large mine site in an area that has been considered promising for decades. Development activity slowed when the leftist regime in Mexico

[221] Emmanuel Latham, Ben Kilbey, "Lithium Supply is Set to Triple by 2025: Will It Be Enough,"? Spgglobal (Oct. 24, 2019); *The Role of Critical Minerals in the Clean Energy Transition,* International Energy Agency (May 2021).

[222] *The Role of Critical Minerals in the Clean Energy Transition,* International Energy Agency (May 2021)..

[223] Pratima Desai, Mai Nguyen, "Shortages Flagged for EV Materials Lithium and Cobalt," Reuters.com (Jul. 1, 2021).

[224] Donghui Liu, Xiangyun Gao, Yabin Qi, Ze Wang, Nanfei Jia, Zihua Chen, "Exploring Behavior Changes of the Lithium Market in China: Toward Technology-Oriented Future Scenarios," Resources Policy, 69 (Dec. 2020) at 101885.

announced possible government ownership of the Project, but the government is now allowing private ownership to proceed.[225] Novel technology will be used to extract lithium from clay soils with the assistance of technical specialists from China. The company has delayed production several times, most recently from 2020 to 2023. Complicating factors include an uncertain regulatory environment and royalty regime, fears that drug cartels could disrupt the Project, and concerns from community, indigenous, and environmental groups about water shortages and water quality.[226]

2. Jadar Lithium-Borates Project, Serbia. In July 2017 the Serbian government and the multinational company Rio Tinto announced plans to launch a major underground lithium mine in western Serbia.[227] A feasibility study is expected by the end of 2021. The first production is scheduled for 2026. Environmental and grassroots opposition to the project is growing, including street protests in Belgrade involving thousands of protesters.[228] A petition calling for a ban of the project garnered 110,400 signatures as of June 10, 2021. The Serbian government has agreed to have a referendum on the project once a comprehensive study of the project is completed.[229]

3. Piedmont Lithium Project, North Carolina, USA. Piedmont Lithium (Australia) has proposed an open-pit lithium mine and processing plant in western North Carolina's Gaston County. The company once had a deal to supply Tesla but that deal has been postponed indefinitely, as the company has experienced delays in securing financing, a state permit, and Gaston County approval. The nearby community is divided about the Project and the Gaston County Commissioners passed a new zoning ordinance in 2021 to ensure adequate County oversight of the mine. The company believes the zoning ordinance will not prevent the Project from moving forward.[230]

4. Silver Peak Mine, south-central Nevada, USA. Albemarle (North Carolina, USA) owns the only active lithium mine in the U.S. in Clayton Valley, Nevada. In 2021 the

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[225] Reuters, "Mexico Turns to Private Sector to Develop Lithium Mining," Mexico News Daily (Jun. 2, 2021).

[226] Ben Heubl, "Mexican Drug Cartels Could Mess Up the Country's Most Important Lithium Project," (Sep. 22, 2020), Eandttheiet.org.org.

[227] Andy Home, "Rio's Lithium Project Will Test Mining's ESG Credentials," Reuters.com (Jul. 29, 2021).

[228] Ivana Sekularac, Aleksandar Vasovic, "Rio Tinto-Led Plan for Major Lithium Mine Stirs Protests in Serbia," Reuters (Aug. 26, 2021).

[229] Eldar Dizdarevic, "Opposition to Rio Tinto's Plan for Major Lithium Mine in Serbia Grows," Bne Intellinews. Intellinews.com (Aug. 27, 2021).

[230] Ernest Scheyder, "Update 2 – North Carolina County Zoning Changes to Affect Piedmont Lithium Project," Reuters.com (Sep. 28, 2021).

company announced plans to double production at the site by 2025.[231] Albemarle has experienced conflicts over water rights with other developers in the water-stressed area.[232]

5. Thacker Pass Project, northern Nevada, USA. Canada's Lithium Americas, with partial backing from Ganfeng (China), plans to launch a new lithium mine from 2022 to 2026 near the border of Nevada and Oregon. In January, 2021, the Bureau of Land Management completed its environmental impact statement on the Project and granted Lithium Americas a permit. A coalition of local and national environmental groups oppose the project but, in the summer of 2021, failed in court to obtain a preliminary injunction against early excavation work at the site.[233] In separate litigation, opponents (which also include a nearby rancher) are challenging BLM's permit decision on multiple grounds such as inadequate consultation with local Tribes and failure to protect that the sage grouse, a bird found in the West that is threatened due to habitat loss.[234]

6. Rhyolite Ridge Lithium-Boron Project, Nevada, USA. Ioneer Ltd (Australia) is developing a major new lithium and boron mine about 220 miles north of Las Vegas. In September 2021, Silbanye Stillwater (South Africa) bought a 50% interest in the project in one of the largest lithium investments in U.S. history. The project is expected to start in 2024, but complications have emerged in the U.S. regulatory system. The U.S. Fish and Wildlife Service, under court order, issued in June 2021 a proposed decision to list a rare desert flower (Tiehm's buckwheat) as an endangered species under the Endangered Species Act. The flower grows on roughly 10 acres within the mine site area. Ioneer believes the mine and the flower can co-exist but a national environmental group, the Center for Biological Diversity, believes the flower cannot be transplanted safely to other nearby soils.[235] The Center is litigating a decision of the Bureau of Land Management to provide an exploratory permit but, meanwhile, the State of Nevada has awarded both water and air permits for the proposed project.[236]

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[231] Staff Reporter, "Albemarle to Double Silver Peak Lithium Production," Mining Magazine (Jan. 8, 2021).

[232] Clayton Valley Water Right, "The Dawn of Discovery," Nevadasunrise.ca (accessed Oct. 1, 2021).

[233] "US Judge Allows Lithium Americas to Start Thacker Pass Excavation," Mining Technology (Jul. 26, 2021).

[234] Staff and Wire Reports, "Lawsuit Filed to Block $1.3 Billion Lithium Nevada Mine Project," Northern Nevada Business Weekly (Feb. 22, 2021).

[235] Brian Bahouth, "Federal Judge Compels US Fish and Wildlife Service to Decide on Tiehm's Buckwheat Protections," Sierra Nevada Daily (Apr. 23, 2021).

[236] Jen Eastwood, "Rhyloite Ridge – First Nevada Lithium Project to be Awarded Key Air and Water Permits," Nevada Business (Jul. 19, 2021).

7. Lithium Extraction in the Atacama Desert, Chile. A decade ago, Chile was the leading producer of lithium in the world but mining progress has slowed. In March, 2018, the two major lithium miners in Chile, state-owned SQM and Albemarle (USA), announced major expansion plans in collaboration with the Chilean government and in conjunction with an elaborate plan by Samsung to build three battery plants in Chile to serve the global electric vehicle market. The deal unraveled when a report of the Chilean government alleged that the existing mining operations of the two companies have exacerbated water shortages in the Atacamera Desert.[237] Indigenous groups and environmental activists also challenged lithium mining in Chile on the grounds of adverse ecological impacts.[238] In 2019, Chile's First Environmental Court ruled in their favor. Meanwhile, China's Tianqi Lithium purchased a 25% interest in SQM, and Albemarle announced a revised plan to enhance yields at its existing lithium mines in Chile, without an expansion of its ecological footprint. Chilean opponents of lithium mining see the writing of the country's new Constitution as a forum to redefine ownership of water rights in a manner that would allow indigenous groups in the Atacama Desert to exert more control over how their land is used.

8. Lithium Extraction in the Atacama Desert, Argentina. Until 2015, FMC Corporation (USA) was the only company doing large scale lithium mining in Argentina. As Chile's mining sector faltered, two consecutive presidents of Argentina attracted Japanese, Australian, French, Chinese and American companies to make new investments in Argentina.[239] The huge new Cauchari-Loaroz Project, by Lithium Americas is scheduled to begin production in 2022.[240] There is some opposition from indigenous groups (e.g., the Kolla communities in the Puna region) and some hydrologists are raising concerns about the potential loss of freshwater resources and adverse ecological impacts. Meanwhile, an NGO called Plurinational Observatory of Andrean Salt Flats (Opsal) links environmental and indigenous activists across The Lithium Triange in Chile, Argentina and Bolivia.[241] Nonetheless, Argentina's mining sector was making progress until the COVID-19 recession and the temporary slump in lithium prices.

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[237] Thea Riofiancos, "The Rush to 'Go Electric' Comes with a Hidden Cost: Destructive Lithium Mining," The Guardian (Jun. 14, 2021).

[238] Wenjuan Liu, Datu B Agustinata, Soe W Myint, "Spatiotemporal Patterns of Lithium Mining and Environmental Degradation in the Atacama Salt Flat, Chile," International Journal of Applied Earth Observation and Geoinformation, 80 (Aug. 2019) at 145-156.

[239] R Ballestra, MP Morelli, M Rattagan, "Lithium Mining in Argentina," Jdsupra.com (Sep. 3, 2021).

[240] Bnamericas, "Argentina Well Placed to Become a Big Lithium Player," Bnamericas.com (Aug. 1, 2020).

[241] Observatoriosalares.org (accessed Aug. 6, 2021).

Whether Argentina can overtake Chile as a leading global lithium miner remains to be seen.[242]

9. The Greenbrushes Mine, Western Australia. The world's largest hard rock lithium mine is a joint venture of Tianqi Lithium Industries (China), Albemarle (USA), and IGO (Australia). It is scheduled for expansion, as the Mine is a major supplier of Tesla.[243] But the mine is only one of a recent proliferation of lithium projects in Western Australia, where a pro-mining culture is pervasive, where major investments in ports and transport infrastructure support mining, and where access to foreign capital (especially from China) has helped finance new projects. In 2017, Australia surpassed Chile as the world's number one lithium miner.

10. Northern Montalegre region, Portugal. Portugal is the only European country with active lithium mining and the national government believes that the northern Montalegre region, which possesses significant lithium reserves, would benefit economically from a new lithium mining sector. With encouragement from the European Union and the national government of Portugal, several developers (e.g., Savannah Resources of the UK) have made preliminary investments in Portugal. However, the local populations in the region and their politicians have mounted sustained opposition to new lithium mines. Fearing the political backlash, the national government adopted a new mining law that provides more royalties and local safeguards for affected local communities. Opponents have already stopped one lithium project and are opposing another that has entered the public consultation phase.[244] The central government has the theoretical power to override local opposition, but it seems unlikely that such a heavy-handed approach will be taken.[245]

11. Direct Lithium Extraction Technology. Several developers around the world are touting a relatively new technology, direct lithium extraction (DLE) from brines, as an environmentally more benign approach compared to the traditional brine methods used

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242 Staff Writer, "Argentina Eyes Lithium Expansion, But Hurdles May Dampen Ambitions," Buenos Aires Times (Dec. 12, 2020).

243 Anthony Barich, "Tesla Chair Says Mining to Underpin Potential Australian Battery, EV Production," Spglobal.com (Jun. 3, 2021).

244 Bryan Carter, "A Portuguese Village Pays the High Price of Low-Carbon Energy," Euronews.com (Apr. 24, 2021).

245 A Hernandez-Morales, SD Mateus, "Portugal to Scrap Lithium Mining Project," Politico.eu (Apr. 27, 2021).

in Chile and the hard rock mining in Australia.[246] DOE is also optimistic about DLE.[247] More R&D investments are necessary to ensure the DLE is economical and can be accompanied with proper management of large volumes of waste that accumulate rapidly.[248] General Motors recently made a significant investment in a DLE venture at the Salton Sea in California.[249] It is too early to judge whether DLE will experience less community and environmental opposition than traditional methods of lithium mining. It may be 2030 or later before this technology has significant market penetration on a global basis.

12. China's Dominance of Lithium Processing. China was once a major player in lithium mining but in recent years has become a large importer of lithium, as China's lithium mines led to significant water pollution and protests among villagers.[250] In order to secure a strong global position in the lithium sector, China's industrial planners – in "China 2025" – urged a move up the value chain to processing and manufacturing.[251] Banks and lithium/cathode companies based in China have collaborated on acquisitions of majority (or substantial minority) interests in lithium mines in South America, Australia, the U.S. and other countries. More importantly, China has assumed a dominant position in the processing of mined lithium into lithium chemicals that are suitable for cathode manufacturing. Virtually all of the lithium mined in Australia is shipped to China for processing. China is now making large new investments in lithium processing to ensure continued dominance.[252] Thus, U.S. and European politicians seeking to avoid dependence on China will need to orchestrate major investments in lithium processing capability in addition to those in lithium mining.

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[246] I Ezama, C Hoyos, P Cortegoso, T Braun, "Direct Extraction Lithium Processes: The Challenges of Spent Brine," Srk.com (accessed Sep. 30, 2021).

[247] Michelle L Price, "Energy Secretary Says US Wants 'Responsible' Lithium Mining," Usnews.com (Jun. 10, 2021).

[248] Ian Warren, *Techno-Economic Analysis of Lithium Extraction from Geothermal Brines*, National Renewable Energy Laboratory, Golden, CO, NREL/TP-5700-79178 (2021).

[249] Mark Vaughn, "GM Will Suck Lithium from the Salton Sea to Make Batteries," Automweek.com (Jul. 15, 2021).

[250] John D. Graham, *The Global Rise of the Modern Plug-In Electric Vehicle: Public Policy, Innovation, and Strategy*, Elgar Publishing, UK (2021), Chapter 9 at 285.

[251] John D. Graham, Keith B Belton, Suri Xia, "How China Beat the US in Electric Vehicle Manufacturing," Issues in Science and Technology (Winter 2021).

[252] Reuters Staff, "China's General Lithium to Launch 60,000 Ton Spodumene Converter by End of 2020," Reuters.com (Apr. 12, 2021).

Cobalt

Cobalt accounts for one-fifth of the material in the cathode of a typical lithium ion battery. It has a stabilizing effect, keeping the layered structure stable as lithium ions travel in the lithium ion cell, and prevents cathode corrosion that can lead to battery degradation and battery fires.

Cobalt is also one of the most expensive materials in an electric vehicle. In 2020, the average spot price of cobalt in the U.S. was $16 per pound, down from a peak of $37.4 per pound in 2018, before the temporary slowdown of EV sales in China (2019-2020). Due to the projected growth in EV sales, Roskill forecasts that global demand for cobalt will rise from 141,000 tons in 2020 to 270,000 tons in 2030.[253]

The rate of growth in cobalt demand from the EV sector is expected to be slower than the rate of growth of lithium demand, as a transition toward lower-cobalt or zero-cobalt batteries is underway.[254] However, the transition to lower-cobalt batteries is occurring more slowly than expected.[255] The consulting firm, Rho Motion, forecasts that cobalt-free batteries will grow in the next decade but not exceed 20% of the global battery market by 2030.

Cobalt supplies do not readily respond to growth in global demand for several reasons. Cobalt is typically mined as a byproduct of copper, and thus it is the demand for copper rather than cobalt that drives the amount of cobalt that is extracted from mines. In other words, the supply of cobalt is not elastic with respect to price.

Moreover, about 60% of the cobalt mined in the world comes from one country, the Democratic Republic of Congo (DRC). The current political leadership of DRC seeks to renegotiate the mining agreements with companies doing business in DRC.[256] Moreover, Chinese companies have purchased a controlling interest in 70% of Congo's copper-cobalt mines.[257] Western businesses are reluctant to make investments in DRC because of political instability, violence and uncertainties about regulation and taxes. There is also evidence that

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[253] Henry Lazenby, "Cobalt Price: 4 New Mutandas Needed by 2030," Mining.com (May 21, 2020).

[254] *The Role of Critical Minerals in the Clean Energy Transition*, International Energy Agency (May 2021).

[255] Priscilia Barrero, "Cobalt Outlook 2021: Demand to Rise, Higher Price Environment Ahead," Investingnews.com (Jan. 6, 2021).

[256] Jevans Nyabiage. China's Cobalt Mines in Spotlight as DRC Seeks to Renegotiate Deals. South China Morning Post. May 22, 2021.

[257] Aaron Ross, Karin Strohecker. Congo Reviewing $6 Bln Mining Deal with Chinese Investors. Reuters.com. August 27, 2021.

child labor is used in DRC's mines, which further discourages investment by Western businesses.[258]

Given constraints on supply growth, deficits in cobalt supply are projected by 2024, which in turn will cause prices to rise further.[259] Experts at RBC predict that cobalt prices will surpass $40 per pound by 2024.[260]

Global cobalt shortages and rising prices are a distinct possibility between 2021 and 2030. In the post-2030 period, low-cobalt and cobalt free battery chemistries may dominate the battery sector. Efforts to diversify cobalt mining and refining are underway in the US and Europe, but they face formidable barriers to success unless they receive strong support from host governments. Since China operates 75% of the world's cobalt refining capacity, there is also strong interest in cobalt refining outside of China. Some of those activities, and the challenges they face, are reviewed below. The non-DRC mines have difficulty competing on price with the DRC mines; the refineries outside of China have difficulty competing on price with China's refineries.

1. Mutanga Mine, Democratic Republic of Congo. The largest copper-cobalt mine in the world is the Mutanda mine in south-east DRC. The mine was closed for several years as the owner (the multinational Glencore), and the DRC had disputes about tax rates, regulations and other issues. Glencore's current plan is to resume production at the mine in 2022.[261]

2. Tenke Mine, Democratic Republic of Congo. The second largest DRC mine, Tenke Fungurume, is owned by China Molybdenum. To capitalize on rising cobalt prices, Molybdenum started in July 2021 a trial production to support a planned $2.8 billion plan to double cobalt and copper output in the mine.[262] However, progress has been

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[258] *E.g.*, Benjamin Sovacool, "When Subterranean Slavery Supports Sustainability Transitions? Power, Patriarchy, and Child Labor in Atrisinal Congolese Cobalt Mining," The Extractive Industries and Society, Vol. 8 Issue 1 (Mar. 2021) at 271-293.

[259] Jacqueline Holman. Cobalt, Lithium to Move Into Deficit by 2024, 2025: MI. spglobal.com. April 28, 2021.

[260] Henry Sanderson, "Cobalt Price Jump Underscores Reliance on Metal for Electric Vehicle Batteries," Financial Times (Apr. 29, 2021).

[261] Hereward Holland, "Glencore Says to Re-Start Congo's Mutanda Mine Towards End of 2021," Reuters.com (Jun. 22, 2021).

[262] Reuters, "China Moly's Congo Mine Expansion Project Starts Trial Production," Reuters.com (Jul. 19, 2021); Tom Daly, "China Moly to Spend $2.5 Bln to Double Copper, Cobalt Output at Congo Mine," Reuters.com (Aug. 6, 2021).

marred by strikes at the mine and a DRC government investigation of the mine and its contracts with the government.[263]

3. Cobalt Mining in Finland. The rising prices of cobalt, and the EU's prioritization of cobalt mining, has stimulated interest in Finland's cobalt mines: three already operating, one in development, three more in the exploration phase. Several can co-produce nickel, zinc and copper. Given the high labor costs, community resistence to mining, and high environmental standards in Europe, it remains to be seen whether the mines in Finland (and elsewhere in Europe) can be globally competitive.[264]

4. Expanded Cobalt Refineries in Brazil and Finland. Jervois Global (Australia) is in the process of acquiring the two largest non-China cobalt refineries, one operated by Freeport Cobalt in central Finland and the other the Sao Miguel Paulista nickel and cobalt refinery in Brazil.[265]

5. New Mine in Northern Ontario, Canada. Fuse Cobalt Inc. (Vancouver) is planning a new mine in the sliver-cobalt producing region of Ontario, based on promising exploratory drilling that began in 1980.[266] Progress has been delayed by cobalt's price volatility and financial issues. The nearby location of a new cobalt refinery (see below) could enhance the mine's prospects for competitiveness.

6. Retooled Canadian Cobalt Refinery. First Cobalt Corporation (Ontario, Canada), with financial assistance from the government of Canada and the Ontario government, has plans to launch in late 2022 the first large-scale cobalt refinery in North America. The new refinery already has cobalt-supply arrangements with DRC mines owned by Glencore and China Molybdenum.

7. New Mine in Utah. Jervois Global (Australia) is planning a new cobalt mine in the state of Utah where both gold and copper are also present.[267] This mine has been under construction since 2012, as the project was first authorized in 2009 by the U.S. Forest Service and delays occurred when a change of mine ownership occurred. The current

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[263] Jevans Nyabiage, "Congo Reviews Chinese Mine Contracts after President Felix Tshisekedi Pushes Back Against Deals Favouring Foreign Firms," South China Morning Post (Aug. 29, 2021).

[264] Hans van Leeuwen, "Commodity-Hungry Europe Gets Ready to Dig Up the Backyard," Financial Review (Jun. 27, 2021).

[265] Soumyajit Saha, "Australia's Jervois Mining to Buy Finland-based Freeport Cobalt for $160 Million," Reuters.com (Jul. 26, 2021).

[266] NOB Staff, "Cobalt Explorer Primed for Action in 2021," Northernontariobusiness.com (Jan. 12, 2021).

[267] Emily Jones, "Cobalt Mine Slated for Salmon-Challis Forest," Idaho Mountain Express (Oct. 1, 2021).

plan is to ship the mine's cobalt concentrate first to a refinery in Brazil and then to a second refinery central Finland, thereby allowing the product to be used by cathode producers.

Nickel

As nickel gradually replaces cobalt in battery designs, the price of nickel will become more important in cathode and battery production. The demand for nickel in the battery market supplements robust demand from the global stainless steel and non-ferrous alloy markets. But battery producers need a special kind of nickel, nickel sulphate, that requires tailored refining techniques.[268]

China remains a top-ten miner of nickel but in recent years has emphasized investments in Indonesia.[269] Other countries engaged in nickel mining are the Philippines, Russia, Canada, and New Caledonia. Australia and Brazil could become major players due to their substantial nickel reserves.

The global supply of mined nickel is somewhat unpredictable because the largest nickel-producing country, Indonesia (>50% of global supply), has experienced chronic governance problems. The country's political culture is sometimes hostile to foreign investment. Even the remote Indonesian island of Wawonii has become a "battleground between villagers and a nickel-mining company backed by Chinese investors."[270] The country's political leadership recently lifted a multi-year ban on nickel exports, which had disrupted the global market for nickel.

The processing of nickel for use in cathodes requires a specialized and more costly leaching process compared to the traditional pyrometallurgical process used to supply the stainless steel sector. China's largest stainless steel producer, Tsingshan Holding Group, is investing up to $15 billion in Indonesia to help supply Class I nickel for the battery market.[271] China's Ningbo Legend has also started a high-pressure acid leach process for nickel on the Indonesian island of Obi.

The U.S. imports the vast majority of its nickel, as only one domestic mine (the Eagle mine in Michigan) is currently operating. This mine ships nickel concentrates abroad for refining.[272] Tesla, to avoid dependence on China and Indonesia, has signed a major nickel

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[268] Andy Home, "China's 2020 Refined Nickel Imports Slump to 6-Year Low," Reuters.com (Feb. 11, 2021).

[269] "China's Huayou Invests $2.1 Billion Indonesia Nickel Project," Cnbc.com (May 25, 2021)

[270] Hans Nicholas Jong, "Nickel Mining Resisted in Indonesia," Chinadialogue.net (Dec. 12, 2019).

[271] Rick Mills, "Is China Locking Up Indonesian Nickel?," Mining.com (Nov. 6, 2019).

[272] James Marshall, "It's Not Just Mining. Refining Holds US Back on Minerals," Eenews.net (Jul. 14, 2021).

supply contract with the company, BHP, which owns a nickel mining operation in Western Australia.[273]

The price of nickel also has a volatile history. The commodity hit an all-time high of $51,600 per ton in 2007 but the price collapsed shortly thereafter. The price remained depressed as China's stainless steel industry shifted to a cheaper form of nickel (nickel pig iron). Near-term price forecasts for nickel, prepared before 2021, were around $16,500 per ton for 2021 and 2022, with further price increases expected as demand for nickel from the battery market expands.[274] In 2021, however, the price of nickel surged past $20,000 per ton, reaching a seven-year high. Growing demand for use in both stainless steel and EV batteries spurred the price surge.[275] Thus, the shift from cobalt to nickel introduces new supply-chain complications.

Rare Earths

The permanent magnets in the electric motors of EVs rely on two specific rare earths: neodymium and dysprosium. Neodymium is valuable because of its strength, its high magnetic force, and its ease of use in the manufacturing of motors. When dysprosium is added, it allows the magnet to tolerate higher temperatures.[276] Toyota has an R&D program to reduce neodumium use in magnets by 50% but implementation is not expected until after 2030.[277]

The land-based process of extracting rare earths entails open pit mining, which leaves an ecological footprint. The dust at the mine can be radioactive because a radioactive element, thorium, is often found with rare earths. Consequently, the wastewater from the mine needs to be handled carefully in order to prevent contamination of nearby surface water and ground water.

Until 1984, the U.S. accounted for a majority of the world's supply of rare earths. The Mountain Pass mine in the Mojave Desert (California) was the single largest source of production. The mine closed in 1982 and China ultimately captured a peak of 95% of global production due to accessible reserves, labor cost advantages, permissive environmental regulation, and state support of rare-earth producers. China's Baotou Steel Rare-Earth High-Tech Co operates a large mine near Baotou in Inner Mongolia. The company extracts rare earths as a byproduct of iron ore mining.

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[273] Financial Times Staff, "Tesla Signs Nickel Deal with BHP to Secure Non-Chinese Supply," Asia.nikkei.com (Jul. 22, 2021).

[274] Yoke Wong, "Nickel Price Forecast: Will the Metal Surge Past $20,000?," Capital.com (Sep. 1, 2021).

[275] Pratima Desai, "Metals: Nickel Prices Soar Alongside Demand and Shortages," Nasdaq.com (Sep. 10, 2021).

[276] John D Graham, T*he Global Rise of the Modern Plug-In Electric Vehicle: Public Policy, Innovation and Strategy*, Elgar Publishing, UK (2021) at 304.

[277] *2021 NAS Report* (*supra* note 37) at 5-82.

In 2011, China and Japan experienced a territorial rights dispute over a fishing incident that occurred in the South China Sea. During the dispute, China introducted several new policies on rare-earth mining and exports: export quotas were reduced; export taxes were increased; and taxes on rare-earth mining companies were increased from $0.50 per kilogram to $8 per kilogram. Provincial and municipal governments also cracked down on unlicensed mining while the central government began stockpiling rare earths at storage facilities under the direction of the Ministry of Land and Resources. At the time, Japan was consuming 20% of the global supply of rare earths, and China was Japan's largest supplier.

The cumulative effect of China's new policies was an explosive spiral in the market prices of rare earths. From May 2010 to June 2011, neodymium spot prices rose from $19 per kilogram to $500 per kilogram.[278] The European Union, Japan and the U.S. protested China's actions and won a lawsuit against China in the World Trade Organization.[279] However, China relaxed its export restrictions before the final WTO ruling and the global price of neodymium collapsed.[280]

After several years of a stable global market for rare earths, China again used rare earths in a geopolitical dispute. During the trade dispute, China invoked retaliatory rare-earth tariffs against the U.S.

Since dependence on China for such a crucial raw material is risky, alternative sources of supply are being pursued eagerly, but with only limited success. For example:

1. Reopening of the Mountain Pass Mine in San Bernardino County, California. With encouragement from the U.S. Department of Energy, Molycorp Inc (Colorado) invested $531 million in a modernization of the Mountain Pass Mine, including a plan to construct a separation and processing facility. The mine reopened for three years but, soon after the collapse of rare earth prices, Molycorp filed for bankruptcy. The new separation and processing facility was not finished. And local government officials worried that the mine site could become an abandoned hazardous waste facility. A consortium of investors acquired the mine at auction in 2017 and the new owner, Mountain Pass (MP) Materials (Las Vegas, Nevada), gradually expanded output from 2017 to 2021, reaching about 15% of global output.[281] However, the mine still has no separation and processing facility and thus ships the mine's output to China for

278 Keith Bradsher, "Costs of Rare Earths Rise with Demand," New York Times (May 3, 2011) B1, B7.

279 Andrew Widener, "WTO Rules Against China's Curbs on Rare-Earth Exports," Chemical and Engineering News, 92(33) (Aug. 18, 2014) at 21.

280 James T Areddy, Chuin-Wei Yep, "China Eases Limits on Rare Earths," Wall Street Journal (Aug. 23, 2012), C3.

281 Subrina Hudson, "Mine Near Las Vegas Produces Much of World's Rare Earth Materials," Las Vegas Review-Journal (May 29, 2021).

processing. One of the company's investors, Shenge of China, acts as a distributor. The company has re-established a multi-year plan to do its own separation and processing (2022) and to make its own magnets for automakers (2025). The target dates may be more feasible now that the company has succeeded in going public (2020) and can better access capital.[282]

2. Expand Production at the Mount Weld Deposit in Western Australia. Lynas Corporation (New South Wales and Malaysia) is developing a large rare earth mine on Mount Weld near Laverton, Australia and a processing facility in Kuantan, Malaysia.[283] The plan for the Malaysian plant experienced setbacks due to community fears of possible exposure to radioactive elements that will be separated from rare earths at the facility. The company is currently adding a cracking and leaching plant at Kalgoorlie, Australia that will process the mine output from Mount Weld, before it is shipped to Malaysia for further processing. Separately, through a 2020 contract with the US Department of Defense, Lynas and its US partner Blue Line Corporation are exploring a new US-based rare earth separation facility.[284]

3. The Dubbo Rare Earths Project, New South Wales, Australia. An agreement between Australian Strategic Materials (ASM) and South Korean investors is developing the Dubbo Rare Earths Project and a new Korean Metals Plant (KMP) that will supply neodymium-iron-boron alloys.[285] The agreement includes a Memorandum of Understanding with two regional governments in South Korea to build the rare-earth processing plant. [286]

4. Access Rare Earths in Greenland. More than 25% of the world's rare earths are located in Greenland, where the rare earth oxides lack the usual contaminants (thorium and fluorine) that require special processing. Both China and the U.S. have expressed strong interest in Greenland. Progress is slow, because an environmental regulatory system is only under development, exploratory efforts are underway, and the country lacks technical expertise in this area.

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[282] Ian Cooper, "MP Materials Stock Worth Watching as Rare Earth Materials Get Even Rarer," Nasdaq.com (Jun. 14, 2021).

[283] Royce Kurmelovs, "The Race for Rare Earth Minerals: Can Australia Fuel the Electric Vehicle Revolution?," The Guardian (Apr. 16, 2021).

[284] Mary Hui, "Lynas is Shaking Up the Supply Chain for Rare-Earth Metals," Qz.com (Jun. 10, 2021).

[285] NS Energy Staff Writer, "South Korean Consortium to Buy Stake in Dubbo Rare Earths Project for $250M," NS Energy (Jul. 21, 2021).

[286] Su-Lin Tan, "Australian Rare Earth Firm ASM Signs South Korea Deal as West Tries to Counter China's Dominance in Critical Minerals," South China Morning Post (Mar. 10, 2021).

5. Ocean Sea-Bed Mining. Materials used in BEVs, rare earths as well as lithium and cobalt, reside in large quantities on the ocean floor. Germany, Japan and Belgium have successfully launched exploitation tests at depths in excess of 2,000 meters. Developers argue that minerals can be readily accessed with advanced vacuum-like technologies that do not require excavation. Environmental groups are urging a precautionary approach to ocean sea-bed mining as the potential ecological impacts are poorly studied. The World Economic Forum launched the Deep-Sea Minerals Dialogue in order to clarify the issues at stake.[287]

   The United Nations International Seabad Authority (ISA) in Kingston, Jamaica is responsible for developing standards and permit procedures for areas of the ocean floor beyond soverign authority.[288] ISA has authorized numerous exploratory activities but, despite more than 25 international meetings of delegates, no clear path forward to development is apparent. The issues are scientifically and philosophically complex, and there are divisive policy questions about how revenues from seabed mining should be distributed. Significant reform of the ISA may be necessary in order to accomplish the goals of the 1994 UN Convention on the Law of the Sea.[289] Most recently, the tiny Pacific island, Nauru, notified ISA that it plans to begin sea-floor mining of its own waters within two years.[290]

In summary, China is the only country with a complete supply chain for rare earths from mining to refining and processing. China currently controls almost 60% of global production capacity and 85% of refining output.[291] With the explosive growth in BEVs globally, the demand for rare earths is outstripping supplies, and the prices of neodymium are rising again.[292]

ESG Constraints on Use of Low-Cost EV Component Suppliers

Automakers and their battery-making partners are under increasing pressure to refrain from using some low-cost suppliers due to environmental, social and governance (ESG) considerations. The battery-price estimates used in the RIAs are industry averages that do not

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[287] Vaishali Dar, "Seafloor Deposits of Minerals Could Soon Become Commercially Available Amid Concerns Over Deep-Sea Mining," Financialexpress.com (Dec. 14, 2020).

[288] ISA, https://www.isa.org.jm (accessed Oct. 6, 2021).

[289] Jonathon W Moses, Anne Morgrethe, "Whose Benefit? A Comparative Perspective for the ISA," Marine Policy, 131 (Sep. 2021) at 104550.

[290] Helen Reid, "Pacific Island of Nauru Sets Two-Year Deadline for UN Deep Sea-Mining Rules," Reuters.com (Jun. 29, 2021).

[291] Dave Makichuk, "Prices Soar as Rare Earth Demand Grows: Report," asiatimes.com (Sep. 15, 2021).

[292] Priscila Barrera, "Rare Earths Outlook 2021: REE Magnet Supply to Remain Tight," Investingnews.com (Jan. 20, 2021).

exclude supply chains that fail ESG tests. Here are some examples of ESG considerations that may preclude use of some low-cost suppliers:

- Suppliers in some countries rely heavily on high-carbon sources of electricity (e.g., Australia, China and Indonesia) such as coal;
- Some suppliers of parts (e.g., cathodes) do not know whether their supply chains utilize mines that violate human rights;
- Some suppliers have low costs because they access raw materials from mines that harm nearby communities with water pollution and mismanagement of wastes; and
- Some suppliers operate in developing countries where corruption of corporate and public officials is commonplace.

For the major global automakers that operate in the US auto market, the RIAs should not assume that low-cost suppliers with poor ESG profiles can be utilized in EV supply chains. As an example, global auto makers are now paying a premium price for nickel sourced outside of Indonesia.[293] In addition to ESG considerations, those premium prices may reflect the need to have a reliable source of supply from a country with stable governance that is not heavily influenced by China.[294] To assist governments, automakers and battery suppliers examine supply chains for ESG issues, both OECD and the IGF have issued advisory management frameworks that emphasize environmental and social considerations.[295] To reflect these cost-increasing considerations in EV production, the RIAs should focus on the cost of supply chains that pass basic ESG tests.

Recycling of Batteries and EV Components

EV battery recycling offers an opportunity to reduce U.S. reliance on foreign nations, and generally on mining, for the critical minerals used in EV batteries while providing national energy security. EV battery recycling is currently in its infancy as there are not a large number of EVs coming out of service. As the EV market becomes more mature, EV battery recycling will similarly grow. The RIAs do not acknowledge that the shift from recycling of engines and transmissions to the recycling of batteries in EVs will impose a net cost on the economy. We encourage the agencies to consider this cost in the final RIAs.

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[293] Henry Sanderson, "Miners Race for Nickel as Electric Car Revolution Looms," Financial Times (Sep. 12, 2021).

[294] O Egbue, S Long, "Critical Issues in the Supply Chain of Lithium for Electric Vehicle Batteries," Eng. Mgmt. Journal, 24(3) (2015) at 52-62.

[295] *Due Diligence Guidance for Responsible Supply Chains of Minerals from Conflict-Affected and High-Risk Areas,* OECD, Oecd.org (accessed Oct. 7, 2021); *Guidance for Governments: Environmental Management and Mining Governance*, IGF, IISD (May 2021).

Recycling of automotive parts, including engines and transmissions, is a mature, commercially successful industry.[296] In the U.S., almost 100% of automobiles are recycled, which in turn creates $32 billion in annual sales and approximately 140,000 jobs.[297] Much recycling of automotive parts will continue with BEVs, because the BEV affects only or primarily the propulsion system in the vehicle. The loss of revenue from recycling of engines and transmissions will nonetheless be significant, as many of the components of engines and transmissions have significant commercial value. The highest value of some engines and transmissions may be in re-use but even recycled materials have significant value, including aluminum blocks, steel parts, heads, intake manifolds and so forth.

The lost revenue from recycling engines and transmissions needs to be compared to the expected revenue from recycling EV batteries. A UK study found that the expected revenues from recycling automotive-grade lithium ion batteries are significantly less than the current costs of recycling.[298] This does not mean that the batteries should not be recycled. The overarching imperative for recycling is to reduce the demands on landfills and other non-sustainable waste-management methods.[299] Moreover, as the prices of raw materials rise, the revenue generation from recycling valuable raw materials from batteries will improve. And, with future innovations, battery recycling may become an economically more compelling enterprise.[300] In the long run (post-2035), recycling of lithium might reduce the global demand for lithium mining significantly, possibly by 25%-40%.[301]

Electricity Price Impacts on Costs of Battery Production

Electricity is the source of energy for an EV, and thus the price of electricity is crucial in any benefit-cost analysis that includes EVs. Electric utilities may need to raise electricity rates in order to expand and modernize the grid to accommodate EVs. Rising electricity prices certainly raise the cost of using an EV, but they also have an indirect effect on the cost of producing EVs, because the supply chain of an EV is much more energy-intensive than the

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[296] Flavius Ion Rovinaru, Mihaela Daciana Rovinarv, Adina Rus, "The Economic and Ecological Impacts of Dismantling End-of-Life Vehicles in Romania," Sustainability, 11 (2019) at 6446.

[297] Rick Leblanc, "Auto Recycling: Recent Trends, Opportunities and Challenges," Thebalancesmb.com (Feb. 26, 2019).

[298] David Greenwood, Martin Dowson, Puja Unadkat, "Automotive Lithium Ion Battery Recycling in the UK. Report Summary," University of Warwick (Sep. 2020).

[299] Gavin Harper *et al.*, "Recycling Lithium-Ion Batteries from Electric Vehicles," Nature, 575 (2019) at 75-86.

[300] Panpan Xu *et al.*, "Efficient Direct Recycling of Lithium-Ion Battery Cathodes by Targeted Healing," Joule 4(12) (2020) at 2609-26.

[301] Richard Harrington, "Mining Our Green Future," Nature Reviews Materials, 6 (2021) at 456-458.

supply chain for an ICE vehicle.[302] At battery manufacturing facilities, for example, large furnaces are required to evaporate the solvents from the coated electrodes; since battery cells are sensitive to moisture, cell assembly must occur in a dry room, which incurs high electricity costs.[303]

Meanwhile, both state and national policies are shifting electricity generation from fossil fuels and nuclear power to renewables, especially wind and solar. At low levels of renewables, the effect on electricity prices may be minimal. Moreover, the cost disadvantages of renewables are declining over time, but the renewables transition may increase electricity prices at higher levels of renewables penetration and will likely raise them further when investments are made (e.g., in grid-scale energy storage solutions) to address the intermittent nature of wind and solar.[304]

It is difficult to estimate how much electricity prices will rise in a precise time frame (e.g., 2024-2026) because they are often determined in utility rate-setting processes in each of the 50 states. And the EIA forecasts of future electricity prices do not account for all the policy changes that are underway or will soon be adopted to promote or compel renewables.

One way for the agencies to bound the potential magnitude of rising electricity prices is to undertake a scenario analysis where all of the U.S. – residences and businesses – face the higher electricity prices now experienced by Germany or the State of California, both jurisdictions that have made determined efforts to boost renewables and phase out coal and nuclear power. Germany has the highest household electricity prices in Europe, about $0.30 per kWh.[305] In May 2021, the average price of residential electricity in California was $0.21 per kWh, about 7% higher than the price in May 2020.[306] In the U.S. as a whole, the average residential electricty price is about $0.13-0.14 per kWh.

The electricity prices paid by businesses need to analyzed separately, as they tend to be higher than the residential rates (in part due to demand charges). The business rate for electricity is appropriate to use when computing the energy costs in the supply chain of battery production. However, since the supply chain for battery producers is global, and electricity prices vary significantly around the world, a detailed analysis of global supply chains is required. In the case of lithium, for example, agencies need to consider the price of electricity

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302 Mark Matousek, "Electric Cars May be the Future, But They're Still Critically Flawed in a Key Area," Business Insider (Nov. 13, 2019).

303 *2021 NAS Report* (*supra* note 37) at 5-100.

304 Michael Schellenberger, "If Solar and Wind Are so Cheap, Why Are They Making Electricity so Expensive?," Forbes.com (Apr. 23, 2018).

305 Eurostat Statistics Explained, Electricity price statistics, Ec.europa.eu (accessed Oct. 6, 2021).

306 Electricate.com (accessed Oct. 6, 2021).

where the lithium is mined, where the lithium is processed, where the lithium is used in cathode production, where the battery cells are made, and where battery packs are assembled. As more of the lithium supply chain develops in the U.S., the analysis will be more straightforward.

In this regard, it is reassuring that the Biden administration is seeking $75 million from Congress for a DOE program to advance lithium recycling.[307] Without such a program, China may be the country best positioned globally to capture the lithium recycling business, as it already has one battery recycling plant in operation and plans to build several more overseas.[308]

In summary, for the next decade or so, the shift from recycling of engines and transmissions to the recycling of lithium ion batteries is expected to impose a net cost on the U.S. economy. That cost should be included in the RIAs in conjunction with estimates of how the cost of battery recycling might decline with appropriate supporting policies (e.g., R&D support).

Modeling of Battery Costs in BatPac

To the extent that some manufacturers begin to vertically integrate and technically differentiate on battery systems, Auto Innovators encourages the Agencies to consider costs and specifications that are reasonable for the industry as a whole to inform policy analysis, and not to assume that intellectual property and proprietary production processes that have been the result of billions of dollars of research and development paid by one manufacturer will be readily available to all manufacturers. In the BatPac model, production volume can affect direct manufacturing cost estimates, and Auto Innovators points out that many battery cells vary (size, shape, chemistry) to suit the application. Even battery packs that share cells may require different housings and assembly processes, requiring separate production lines, resulting in economies of scale lower than would be projected if all these parts were the same. Total industry volumes of BEVs are not an appropriate volume assumption for BatPac. Auto Innovators recommends that EPA update their approach to that used in the NHTSA analysis to estimate battery costs for strong hybrids, PHEVs, and BEVs, considering vehicle type and synergies with other fuel saving technologies. That analysis could be improved by using the BatPac results for BEV400s and BEV500s, instead of scaling up BEV300 costs.

<u>User Costs of Electric Vehicles</u>

Compared to many "invisible" technologies used by vehicle manufacturers to comply with CAFE and GHG standards (e.g., fuel efficient technologies that are integrated into the vehicle with little to no consumer visibilty or change to the driving experience), BEVs and

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[307] Jon Greenberg, "Fact Check: Is Biden Ignoring the 'Negative Environmental Impacts' of Lithium Mining," Austin American Statesman (Jun. 10, 2021).

[308] Anne Lee, "China Giant Ganfeng Says Lithium May Rally to Boom-Time High," Bloomberg.com (Jun. 24, 2021).

PHEVs are a new technology type for many drivers and, as a result, may incur some costs and inconveniences that should be addressed in the RIAs.

First, the RIAs do not incorporate the costs of charging stations for BEVs and PHEVs, and the summary cost tables do not appear to include the expenditures on electricity consumed by BEVs and PHEVs.

Level 1 charging will likely be too slow for many motorists unless their vehicles are only driven short distances on a regular basis, and thus access to a Level 2 charging station at home or at work will usually be a minimum infrastructure for a BEV or PHEV, especially as battery capacity increases to support longer vehicle driving range. The equipment and labor costs for installation of Level 2 charging typically run somewhere between $500 to $2,000, depending on location, i.e., single family home versus multi-family; a small additional charge for maintenance/repair of the charging stations should be added. Level 3 fast chargers can run into the tens of thousands of dollars and are typically confined to business and commercial applications.[309,310]

At relatively low levels of EV penetration by prosperous early adopters, where home charging is the predominant method of charging, the agencies could offer a simplified analysis based on a simulated national distribution of charging events: 13% Level 1 charging, 68% Level 2 home charging, 14% Level 2 workplace or public charging, and 5% DC fast charging.[311] Based on those assumptions and national-average electricity prices, the levelized cost of charging (which accounts for equipment, installation, and use) is about $0.15/kWh (NAS, 2021, 5-126). The estimates of induced electricity consumption in the RIAs, which were used to compute lifecycle emissions, could be multiplied by the levelized cost of charging to provide a rough estimate of electricity and infrastructure costs induced by the assumed low penetration rates of BEVs and PHEVs. Such costs are reasonably attributable to the proposed standards since the standards are designed explicitly to encourage BEV and PHEV offerings, the agencies estimate that the standards will cause more BEV and PHEV penetration, and the proposed standards are apart of a national policy initiative of 50% PEV penetration by 2030. As the country moves beyond early adopters toward higher levels of BEV penetration near the national goal, many targeted urban dwellers and less-prosperous households may lack a home charging arrangement. A more sophisticated analysis will be required at this point.

Second, the Agencies need to estimate the costs to the user of a vehicle that has a shorter driving range than the typical ICE vehicle and that requires a long time to charge compared to five minutes at a gasoline refueling station. A series of stated preference studies have found that

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[309] *See,* Atlas Policy, "U.S. Passenger Vehicle Electrification Infrastructure Assessment; Results for Light-duty Vehicle Charging," Apr. 21, 2021. https://atlaspolicy.com/wp-content/uploads/2021/04/2021-04-21_US_Electrification_Infrastructure_Assessment.pdf

[310] *2021 NAS Report* (*supra* note 37).

[311] *Id.*

consumers are willing to pay a higher purchase price for vehicles with longer driving range and shorter refueling/recharging times. The authors of a meta-analysis of 33 consumer preference studies found that "short-range cars entail important losses for the average consumer."[312] This preference was found in Nordic countries, where electric vehicle penetration is relatively high, and in the U.S., where EV penetration is relatively low.[313] The magnitude of the preferences are substantial, with one early study showing willingness to pay at purchase of $35-$75 for each mile of added driving range, and $425-$3250 for each hour of reduced charging time.[314] The first-generation, short-range BEVs (e.g., the early version of the Nissan Leaf) were not used nearly much as ICE vehicles; their annual mileage was more than 40% less than average ICE vehicles.[315] As automakers have extended the range of BEVs from less than 100 miles to 200-300 miles, their perceived disadvantage compared to ICE vehicles has lessened.

Third, the time spent charging an EV needs to be considered. NHTSA – but not EPA – includes an estimate of the time costs of charging a BEV or PHEV during long trips that occur within one day. To be complete, the time cost should include any additional travel time to the charging station, any expected delay in accessing a charging point, and time spent during the charging event. As more EVs are sold in states with cold winters, the burden of extended, outdoor public charging in cold weather should be considered (as California's temperate coastal climate is not representative of the U.S.).

The bottom-up costing method used by NHTSA is defensible, and should be considered by EPA, but both agencies may wish to explore alternative approaches to measuring the hedonic cost to an owner of a BEV that has a shorter range and longer charging time than a comparably-sized ICE vehicle. EPA does provide different technology costs for a BEV200 and BEV300 but does not offer any estimate of the user benefit of the long-range BEV. NAS (2021) makes some logical arguments that consumers should be willing to make some compromises on driving range and charging time, but more behavioral research is needed to determine whether NAS's view is shared by consumers.

In summary, the Agencies need to depart from their historical practice of assuming that CAFE compliance technologies have zero costs to the user (beyond the purchase price). The electrification technologies, especially BEVs and PHEVs, entail a significant change in how motorists engage with the transportation and electric-utility systems.

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312 A Dimitropoulos, P Rietreld, JN van Ommeren, "Consumer Valuation of Changes in Driving Range: A Meta-Analysis," Transportation Research Part A: Policy and Practice, 55 (2013) at 27-45;

313 L Noel *et al.*, "Willingness to Pay for Electric Vehicles and Vehicle-to-Grid Applications: A Nordic Choice Experiment," Energy Economics, 78 (Feb. 2019) at 525-535.

314 MK Hidrue *et al.*, "Willingness to Pay for Electric Vehicles and their Attributes," Resource and Economics, 33(3) (Sep. 2011) at 686-705.

315 David Lucas, "How Much Are Electric Vehicles Driven?," Applied Economics Letters, 6(1) (2019) at 1-6.

Employment Impacts of the BEV Transition

The proposed standards, insofar as they boost the BEV transition, will have complex impacts on employment in different sectors and different regions of the country. Auto Innovators recommends that the Agencies go beyond the current rudimentary analysis in the RIAs (which considers only new vehicle sales and stimulus of battery manufacturing) and consider employment analysis of each of the following issues.

1. The impacts of BEVs on employment at U.S. plants that produce gasoline engines and transmissions, and their supply chains.

2. The impacts of BEVs on employment in the U.S. petroleum and biofuels sectors, including their supply chains.

3. The employment impacts of BEV production in the U.S. and elsewhere, accounting for the global geographic distribution of the mining and processing of raw materials, the manufacture of cathodes, anodes, electrolytes and separators, the production of battery cells and the assembly of battery packs, and the production of electric motors and other systems/components (e.g., charging networks) that are critical to BEVs.

It would be useful for the agencies to present geographical maps of where in the US employment is likely to be lost, where employment gains are likely to occur, and what the net distribution of employment changes will be in different regions. The offsetting effects are challenging to model but are important to appreciate.[316] Such information could be useful in guiding retraining and community assistance programs. A think tank in Germany has produced a related study on how the BEV transition might impact employment in towns throughout Germany.[317]

Potential Impacts of Raw Material Sourcing , Cell Production, and Pack Assembly on U.S. Content

The NHTSA analysis correctly shows that direct manufacturing costs related to batteries are a significant portion of electrification technology costs. Historically, the permitting process for establishing mining operations on U.S. soil and for building new production and assembly capacity is lengthy. As electrified fuel saving technologies are more widely adopted, significant uncertainty remains about how well extrapolating future percent U.S. content from current percent U.S. content will characterize the supply chain, and employment. Particularly for light trucks, production locations, and supply chains may interact with other policies, such as trade

[316] Sanya Carley *et al.*, "The Macroeconomic Effects of Model Year 2017 through 2025 Federal Fuel Economy and Greenhouse Gas Standards," Journal of Policy Analysis and Management, 38(3) (2019) at 732-763.

[317] M Nienaber, "Switch to Electric Puts Over 100,000 German Auto Jobs at Risk," Reuters.com, (May 6, 2021); O Falck, N Czernich, J Koenen, "Effects of Increased Production of Electric Vehicles on Employment in Germany," Ifo Institute, Ifo.de (2021).

and tariff policies, which may materially affect future costs, availability of parts, and the ability of manufacturers to rapidly bring fuel saving technologies to market. The projected future scale of transportation-related production of some technologies (such as batteries), as forecast in the NPRM compliance pathways, often implies an order of magnitude or larger production and throughput than the currently observed global supply, across all industries. Auto Innovators recommends frequent review and update of rule-making input assumptions related to percent U.S. content, based on observed market conditions.

EPA and NHTSA project that battery costs will learn down quickly compared to other fuel saving technologies, and the employment module uses total technology costs to help forecast job-years. Given the Agencies' assumptions, it is notable that the projected jobs related to the production of batteries will shrink (on a per unit shipped basis) in proportion to the learning rate of batteries. Employment related to the production of engine and transmission technologies (on a per unit shipped basis), are stable over time in comparison.

Appendix VIII: Comments on Technical Modeling

Comments on CAFE Model Inputs

Assumptions in the Baseline Alternative

This section summarizes assumptions in the "baseline" (Alternative 0) in the central case, standard-setting runs in the CAFE Model. The section describes how the Department of Transportation included increased usage of off-cycle technologies, the California Framework Agreements, and the ZEV program in baseline projections. These projections increase the amount of fuel-saving technologies projected in the "baseline", independent of CAFE regulations, through 2027 MY, and, as a result, affected the compliance pathways projected in the CAFE standard-setting runs. Because the sales module only considers fuel-saving technology cost in excess of baseline projections to affect sales volumes, the assumptions increase the fuel economy of the fleet, and associated costs, without decreasing forecast sales, or fleet turnover. As a result, sales impacts may be understated in some scenarios by a factor of more than two.

The following sections discuss DOT modeling of the off-cycle credit program, the California Framework Agreements, and the California ZEV Mandate. Each section discusses how these new approaches compare with approaches from previous CAFE rulemakings. Many of these modeling assumptions about future adoption of fuel-saving technologies beyond what is observed in the 2020 fleet are imbedded in the Market Data file, and therefore cannot change between scenarios. To properly incorporate some recommendations, the CAFE model will need a baseline reference Market Data file (with a reasonable ramp of Credits and Adjustments for Scenario 0) as well as a compliance forecast Market Data File (one that may include the Central Case ramp rate for Credits and Adjustments manufacturers may reasonably use to comply with Alternative 2, for instance, and any other regulatory programs that may be fit to include in the CAFE rulemaking analysis). Any projected sales response should consider the technology cost difference between the baseline and the forecast. The analysis methodology shared by the DOT in the proposed rulemaking bakes in too many costs for yet-to-be-adopted fuel-saving technologies into the baseline, and under-reports the impact of these additional costs on sales and fleet turnover. Auto Innovators provides some recommendations to improve modeling.

Off-Cycle Technologies

NHTSA forecasts how manufacturers are expected to earn A/C efficiency, A/C leakage, and off-cycle credits in the Market Data File on the "Credits and Adjustments" tab. These forecasts are used for all alternatives, with no change between the baseline case and other regulatory alternatives. New for this rulemaking, EPA and NHTSA proposed to increase the cap on off-cycle credit menu technologies, and across the industry, NHTSA projects off-cycle credits will be used to a lesser extent for passenger cars (Table VIII-1), and to a greater extent for light trucks (Table VIII-2) than assumed in previous rulemakings. Chapter 3.8 of the TSD briefly describes the rationale for the updated forecasts, connecting back to the 2020 EPA Trends Report, and then extrapolating forward, for each manufacturer, a generic adoption rate reflecting analyst judgement.

Table VIII-1: Comparison of Projected Passenger Car A/C Efficiency, A/C Leakage, and Off-Cycle Credits Between the 2020 SAFE Rule and the CAFE NPRM

Passenger Car - Sales Weighted Average of Credits and Adjustments						
	2020 Final Rule AC Efficiency	2021 DOT NPRM AC Efficiency	2020 Final Rule AC Leakage	2021 DOT NPRM AC Leakage	2020 Final Rule Off-Cycle	2021 DOT NPRM Off-Cycle
2020	4.3	4.0	10.1	10.6	6.4	4.3
2021	4.5	4.2	11.3	11.3	7.6	5.1
2022	4.8	4.5	12.5	12.3	8.8	5.6
2023	5.0	4.8	13.7	13.1	10.0	6.2
2024	5.0	5.0	13.7	13.4	10.0	6.8
2025	5.0	5.0	13.7	13.7	10.0	7.7
2026	5.0	5.0	13.7	13.7	10.0	8.1
2027	5.0	5.0	13.7	13.8	10.0	8.3
2028	5.0	5.0	13.7	13.8	10.0	8.3
2029	5.0	5.0	13.7	13.8	10.0	8.3
2030	5.0	5.0	13.7	13.8	10.0	8.3
2031	5.0	5.0	13.7	13.8	10.0	8.3
2032	5.0	5.0	13.7	13.8	10.0	8.3

Table VIII-2: Comparison of Projected Light Truck A/C Efficiency, A/C Leakage, and Off-Cycle Credits Between the 2020 SAFE Rule and the CAFE NPRM

Light Truck - Sales Weighted Average of Credits and Adjustments						
	2020 Final Rule AC Efficiency	2021 DOT NPRM AC Efficiency	2020 Final Rule AC Leakage	2021 DOT NPRM AC Leakage	2020 Final Rule Off-Cycle	2021 DOT NPRM Off-Cycle
2020	6.5	6.2	15.0	13.6	9.2	9.2
2021	6.8	6.6	15.7	14.4	9.5	10.7
2022	7.0	6.9	16.5	15.2	9.7	11.3
2023	7.2	7.1	17.2	15.5	10.0	12.1
2024	7.2	7.1	17.2	16.0	10.0	13.0
2025	7.2	7.2	17.2	16.4	10.0	13.5
2026	7.2	7.2	17.2	16.7	10.0	14.0
2027	7.2	7.2	17.2	17.1	10.0	14.1
2028	7.2	7.2	17.2	17.1	10.0	14.1
2029	7.2	7.2	17.2	17.2	10.0	14.2
2030	7.2	7.2	17.2	17.2	10.0	14.2
2031	7.2	7.2	17.2	17.2	10.0	14.2
2032	7.2	7.2	17.2	17.2	10.0	14.2

Due to the static nature of the forecasts and input structure, the NHTSA forecasts on the quantity of off-cycle credits do not vary by scenario, and this creates material distortions in the model outputs. For instance, the projected Central case adoption of off-cycle technologies may contribute to over-compliance with some scenarios, especially low stringency scenarios. It is unlikely that manufacturers would continue to add off-cycle technologies to the extent assumed in some modeled Alternatives, like the 1 MPG case, or the baseline Alternative 0. Furthermore, some off-cycle technologies are not applicable to battery electric vehicles, but the forecasts are independent of the extent to which plug-in vehicles may be used in future fleets. With the forecast proposed by NHTSA, the analysis bakes in a few hundred dollars per vehicle of technology cost in the baseline and excludes these costs from affecting the new vehicle sales model outputs.

CARB Framework Agreements

New for the CAFE NPRM, the CAFE Model assumes that some manufacturers will voluntarily build future fleets that comply with standards more stringent than the 2020 SAFE Rule final standards. The additional future cost of the fuel-saving technologies necessary to meet these obligations is considered in the baseline scenario; therefore, these additional future costs are not projected to affect future sales. Table VIII-3 demonstrates the percentage of the fleet this concern applies to.

Table VIII-3: Framework Agreement Participation Rates

Framework Agreement Participation Rates				
	2020 DC Regulatory Class	2020 IC Regulatory Class	2020 LT Regulatory Class	2020 Fleet Total
CARB Framework Agreement 2020 Unit Sales	1,061,598	522,074	2,222,727	3,806,399
Non-Framework 2020 Unit Sales	1,718,863	2,627,067	5,440,222	9,786,152
2020 Fleet Total	2,780,461	3,149,141	7,662,949	13,592,551
CARB Framework Agreement Percentage of 2020 Sales	38.2%	16.6%	29.0%	28.0%
Non-Framework Percentage of 2020 Sales	61.8%	83.4%	71.0%	72.0%
Fleet Total Percentage of 2020 Sales	100.0%	100.0%	100.0%	100.0%

NHTSA identifies Framework Agreement companies in the "Manufacturers" tab of the Market Data File, under the "CARB Agreement" heading, with a "TRUE" setting. In order to understand the magnitude of future additional costs for Framework Agreement companies to comply with the Framework Agreements (which are currently modeled in the baseline, and therefore do not affect the future sales forecast), a separate set of runs for the CAFE model may be conducted with all companies set to "FALSE".

ZEV Mandate

Also new for the CAFE NPRM, the CAFE Model incorporates a compliance pathway for the California ZEV Mandate into MYs 2021-2027 (to roughly hit a MY 2025 target) and assumes manufacturers will meet these obligations with battery electric vehicle technology.[318] About 1.5 percent of the MY 2020 fleet is tagged as a "ZEV Candidate" in the Market Data File's Vehicles tab, and this forces the model to adopt BEV technology at the first vehicle redesign, independent of modeled future CAFE regulations. BEV technology is very fuel-efficient and is a technology that delivers very high fuel economy contributions for fleets in the CAFE program. About 2% of the observed MY 2020 fleet uses battery electric vehicle technology as a starting point in the DOT analysis, which is in addition to the "ZEV Candidate" vehicles identified to adopt BEV, alternative fuel technology in the future.

Table VIII-4: ZEV Candidate Vehicles by Model Year

Redesign Year	MY 2020 cumulative sales count of "ZEV Candidate" vehicles	MY 2020 percentage of fleet tagged as "ZEV Candidate"
2021	24,828	0.18%
2022	51,144	0.38%
2023	77,972	0.57%
2024	125,824	0.93%
2025	189,745	1.40%
2026	198,290	1.46%
2027	204,021	1.50%

It is notable that previous NHTSA rulemaking activities, such as the 2016 Draft Technical Assessment Report analysis, were careful to exclude dedicated alternative fuel vehicles, commonly associated with ZEV Mandate compliance, from the baseline, based on statutory constraints.[319]

In MYs 2020-2026, the NHTSA analysis shows that, for nearly all vehicles, BEV technology is more expensive than fuel-saving technology on internal combustion engine counterparts. By forcing BEVs to be adopted in all regulatory scenarios, the additional future technology costs associated with the ZEV Mandate are included in all scenarios, and the incremental cost between scenarios is zero (the costs are hidden from most modules in the CAFE program designed to account for additional technology cost relative to the observed starting point fleet, because the modules use the incremental cost between scenarios). The modeling approach used for ZEV in the CAFE NPRM inflates the expected fuel economy of the fleet for all scenarios. With this modeling approach, other important modeling metrics with incremental cost as an input (such as sales with a unit elasticity response, and subsequently

[318] *See* our comments in Appendix IV, "NHTSA Has Improperly Considered Electric Vehicles in its Standard Setting."

[319] For discussion on whether NHTSA ought to include alternative fuel vehicles in its analysis in this manner, see Appendix IV. The comments in this section address NHTSA's analysis as executed for the CAFE NPRM.

employment, which uses sales projections) misconstrue the effects of the cost of the ZEV program entirely.

It's possible to assess the cost of additional technologies to comply with the ZEV Mandate, as modeled, by removing the tag for "ZEV Candidate" vehicles in the Market Data File and comparing model output average technology costs with the Central Case, Alternative 0 outputs.

Accounting for ZEV Mandate, California Framework Agreements, and Off-Cycle Credits

Costs associated with the California ZEV Mandate, California Framework Agreements, and a rapid ramp of off-cycle technologies should be properly accounted for relative to the MY2020 fleet.[320] If NHTSA is going to consider the projected fuel savings benefits of complying with other regulations and commitments, NHTSA should, too, consider the costs of these programs. The way NHTSA has included future costs of fuel-saving technologies for other regulatory programs incorrectly accounts for how those programs affect substantive metrics, like new vehicle sales. The resulting distortions are material to cost-benefit analysis. If in the future NHTSA chooses to consider the incremental fuel savings benefits of other regulatory programs not yet incorporated in the observed fleet, so too should NHTSA correctly consider and account for the incremental costs of those future additional technologies, and the effect additional costs of yet-to-be-produced technologies will have on industry sales.

Table VIII-5 compares the average technology cost in response to Alternative 0 for the Central Case assumptions used by the Agency with sets of assumptions that may more reasonably characterize "baseline" in a way that is appropriate and consistent with the form of CAFE Model sales and employment module inputs. For the example input files, ZEV candidates are set to blank in the Market Data File, and the California Framework Agreements, or CARB Agreement as designated in the file, is set to "FALSE" for all manufacturers. Additionally, in one example, the off-cycle and A/C credit values carry forward MY 2022 values to MYs 2023-2032. With these straightforward input changes, the average regulatory cost of meeting the baseline standards (Alternative 0) in 2026 is cut roughly in half (from $1,169 to $576, a difference of $593).

[320] However, see our comments at Appendix IV.

Table VIII-5: Reported Regulatory Cost and Comparison to Modified Modeling

"Compliance Report" Average Regulatory Cost (Avg Reg-Cost), Scenario 0 (Safe Final Standards)			
Model Year	***Proposed Baseline "A"*** **Market Data File Updates** • No "ZEV Candidates" • No "CARB Agreement" • "Credits and Adjustments" held at 2022 values from 2023-2032	***Baseline "B"*** **Market Data File Updates** • No "ZEV Candidates" • No "CARB Agreement" • "Credits and Adjustments" unchanged from Central Case	**Central Case used by DOT in NPRM Standard Setting Runs** • MY2025 ZEV in all scenarios • CARB Agreement in all scenarios • Rapid ramp up of "Credits and Adjustments" in all scenarios
2020	$202.79	$202.79	$202.79
2021	$244.51	$244.42	$366.83
2022	$393.48	$393.56	$611.24
2023	$453.27	$493.66	$767.65
2024	$512.37	$593.97	$968.72
2025	$539.59	$669.90	$1,082.98
2026	**$576.01**	**$732.45**	**$1,168.59**
2027	$572.41	$739.71	$1,160.45
2028	$571.49	$733.29	$1,139.97
2029	$576.20	$737.07	$1,120.11
2030	$569.71	$727.69	$1,092.66
2031	$553.74	$708.85	$1,059.26
2032	$542.16	$695.19	$1,029.03
2033	$533.14	$683.07	$1,002.69
2034	$527.83	$676.40	$980.03
2035	$519.89	$666.10	$957.29

NHTSA reported four sets of Alternative standards in the NPRM, with the average regulatory cost for "Alternative 1", "Alternative 2", and "Alternative 3" being reported relative to "Alternative 0" (the $1,168.59 in 2026 as shown in Table VIII-5). Table VIII-6 summarizes the projected MY 2026 average regulatory costs, as reported by NHTSA in the Central Case, and as the average regulatory costs would be reported relative to Proposed Baseline "A".

Table VIII-6: Comparison of Regulatory Cost for Alternatives 1-3 Against Other Modeling Assumptions

	Alternative 1	Alternative 2	Alternative 3
2026 Average Incremental Regulatory Cost relative to Alternative 0 with Central Case assumptions ($1,168.59)	$484.12	$1,067.49	$1,604.81
2026 Average Incremental Regulatory Cost relative to Alternative 0 with Proposed Baseline "A" assumptions ($576.01)	$1,076.70	$1,660.07	$2,197.39
Total 2026 Average Regulatory Cost (including $202.79 for 2020 as reported in Central Case output files)	$1,652.71	$2,236.08	$2,773.40
Percent of Incremental Average Regulatory Cost considered by sales module in Central Case, relative to Baseline "A" assumptions	45%	64%	73%

The CAFE sales module applies unit elasticity to costs incremental to those projected in Alternative 0. Because the Central Case Alternative 0 costs are large in future years, due in part to the inclusion of the ZEV Mandate, California Framework Agreements, and an assumed rapid adoption of "Credits and Adjustments", flexibilities independent of the scenario considered, the incremental costs for Alternative 1, Alternative 2, and Alternative 3 are under-reported (by $592 in MY 2026 when using Proposed Baseline "A", for instance). The CAFE Model skews towards projecting over-compliance for regulatory scenarios with gradual increases in stringency.

Using data in the MY 2020 Market Data File, the sales weighted MSRP for the MY 2020 fleet is $36,446. Referencing the Proposed Baseline "A", $592 is 1.63% of the sales weighted MSRP. The table below is a simple back-of-the-envelope calculation to show the potential sales impact of NHTSA's baseline reporting choice.[321] While the Central Case projections show a difference between Alternative 0 and Alternative 3 of 564,643 annual sales, changing the baseline to one that would allow the model to actually account for the incremental costs of fuel-saving technologies that must be added beyond what is observed in the MY 2020 fleet to comply with the ZEV Mandate program, the California Framework Agreements, and rapid adoption of A/C and off-cycle technologies could show an additional sales loss of about 260,000 units. Because sales outputs are inputs for employment, the employment projections would materially change as well. These are important factors for economic practicability and NHTSA should address these concerns.

[321] The sales module has other components, such as fleet mix, and an autoregressive component that may affect sales projections, but they are ignored here, for simplicity.

Table VIII-7: Degree of Unreported Sales Losses Associated with Inclusion of the ZEV Mandate, Framework Agreements, and Off-Cycle Credits in the Baseline

	2026 NPRM Central Case Sales	2026 Projected Sales Reduced by 1.63%	2026 Unit Sales Over Reported in Central Case
Alternative 0	16,391,607	16,124,424	267,183
Alternative 1	16,236,163	15,971,514	264,649
Alternative 2	16,020,738	15,759,600	261,138
Alternative 3	15,826,964	15,568,984	257,980

NHTSA's choice of including the ZEV Mandate, California Framework Agreements and various credits in the baseline has significant impacts on the results from the CAFE Model sales module. Including the cost of technologies in the baseline that have not yet been applied in the observed analysis fleet[322] is not well-advised. Just because additional flexibilities may be included in the program does not mean manufacturers will use them (at some cost) for all scenarios. However, for rapid increases in standards (like those proposed in Alternatives 1, 2, and 3), additional flexibilities are an important pathway that many manufacturers will likely use.

Manufacturer Willingness to Pay CAFE Civil Penalties

Civil penalty payment preferences appear contradictory. In past rulemakings, as well as in today's NPRM, NHTSA considers that, for a time, some manufacturers may not comply with the CAFE standards, and instead choose to pay civil penalties. Although some manufacturers have paid civil penalties in the past, their willingness to do so with a steeply increased penalty rate is more questionable.[323] To the extent NHTSA models manufacturers as willing to pay civil penalties, Auto Innovators questions some of the assumptions made and their impact on model outputs.

Civil penalty payment preferences are listed in the model inputs in the Market Data File, on the "Manufacturers" tab. As implemented in the CAFE Model, civil penalty payment can, for a time, smooth out the projected adoption rates of very expensive technologies (e.g., SHEVP2, PHEV, MR5/6, *etc.*) that greatly enhance fuel economy. Allowing civil penalty payment in response to modeled standards can lead to projected compliance pathways with less abrupt adoption of very expensive fuel saving technologies (which is notionally relevant for discussions of technological feasibility). Also, choice of inputs for manufacturer willingness to pay civil penalties is a modeling flexibility that can lower projected industry over-compliance, because if civil penalty payment is not preferred for a year, the CAFE Model projected compliance pathway for the manufacturer will always *at least* comply with standards in that

[322] As reflected by compliance data, submitted by manufacturers, and used as the starting point for the industry sales and technology content of the fleet.

[323] Civil Penalties; Supplemental Notice of Proposed Rulemaking, 86 Fed. Reg. 46811 (Aug. 20, 2021).

year.[324] For some manufacturer's fleets, particularly those with few vehicles and long times between projected redesigns, solutions may appear blocky.

In the 2020 SAFE Rule, few manufacturers were projected to prefer to pay civil penalties in MYs 2018-2020 (Table VIII-8).

Table VIII-8: 2020 SAFE Rule Inputs for Manufacturer Willingness to Pay CAFE Civil Penalties

General	2020 SAFE Final Rule Assumptions - Prefer Fines																	
Manufacturer Name	PF-2015	PF-2016	PF-2017	PF-2018	PF-2019	PF-2020	PF-2021	PF-2022	PF-2023	PF-2024	PF-2025	PF-2026	PF-2027	PF-2028	PF-2029	PF-2030	PF-2031	PF-2032
BMW	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
Daimler	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
FCA	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
Ford	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
General Motors	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Honda	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Hyundai Kia-H	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Hyundai Kia-K	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
JLR	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
Mazda	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Mitsubishi	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Nissan	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Subaru	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Tesla	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Toyota	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
Volvo	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N
VWA	Y	Y	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N

For the purposes of the CAFE NPRM analysis, all manufacturers are given the option to pay civil penalties through MY 2023, and six manufacturers are given the option in modeling to pay civil penalties all the way to MY 2032 (Table VIII-9). Notably, some companies given the option of paying civil penalties for an extended duration have "CARB Agreement" set to "TRUE" on the same input tab, which is a highly unusual combination of assumptions.

[324] Projected over-compliance in modeled response to a standard is not necessarily evidence that more stringent standards are appropriate.

Table VIII-9: CAFE NPRM Analysis CAFE Model Inputs for Manufacturer Willingness to Pay Civil Penalties

General	2021 NPRM DOT Assumptions - Prefer Fines																	
Manufacturer Name	PF-2015	PF-2016	PF-2017	PF-2018	PF-2019	PF-2020	PF-2021	PF-2022	PF-2023	PF-2024	PF-2025	PF-2026	PF-2027	PF-2028	PF-2029	PF-2030	PF-2031	PF-2032
BMW	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Daimler	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
FCA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Ford	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
GM	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Honda	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Hyundai Kia-H	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Hyundai Kia-K	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
JLR	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Mazda	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Mitsubishi	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Nissan	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Subaru	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Tesla	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Toyota	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
Volvo	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
VWA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

Setting civil penalty payment preferences in the short-term may help smooth out technology pathways and over-compliance, but the assumption obscures how much electrification the fleet must incorporate over the next few years to comply with today's proposed standards.[325]

President Biden's Executive Order 14037 sets a goal that 50 percent of all new passenger cars and light trucks sold in 2030 be zero-emission vehicles, including battery electric, plug-in hybrid electric, or fuel cell vehicles.[326] Setting aside legal considerations for inclusion of dedicated and dual fuel alternative fuel vehicles, in order to comply with today's

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[325] As noted elsewhere, inclusion of dedicated alternative fuel vehicles and the alternative fuel operation of dual fueled vehicles would violate 49 U.S.C. § 32902(h)(1) or (2).

[326] *Executive Order on Strengthening American Leadership in Clean Cars and Trucks*, The White House, https://www.whitehouse.gov/briefing-room/presidential-actions/2021/08/05/executive-order-on-strengthening-american-leadership-in-clean-cars-and-trucks/ (accessed Oct. 15, 2021).

proposed standards for MYs 2024-2026, lots of electrification is needed, and the technology must be developed rapidly and adopted widely. The civil penalty payment preferences, set as they are, lead to compliance pathways with lower projected penetration rates of exactly the types of technologies that are stated to be 2030 policy objectives for EPA and NHTSA.

Setting civil penalty payment option to "N" in 2024 and beyond for all manufacturers in standard-setting runs would demonstrate technology pathways that highlight the difficulty manufacturers face in complying with rapid increases in standards with limited lead-time. A significant portion of manufacturer action to comply with MY 2024 standards occurs in MY 2023, which is expected given that not every vehicle is redesigned every year.

Comments on Potential Future Technology Additions

Aside from the previous discussion of HCR2, which is a prominent issue in EPA's analysis with respect to technological feasibility, Auto Innovators provides the following comment and guidance for current and near-future analysis.

The Agencies should maintain a performance-neutral approach when estimating technology benefits.

Vehicle design parameters are never static. With each new generation of a vehicle, manufacturers seek to improve vehicle utility, performance, and other characteristics based on research of customer expectations and desires, and to add innovative features that improve the customer experience. The Agencies have historically sought to maintain the performance characteristics of vehicles modeled with fuel economy-improving technologies. Auto Innovators encourages the Agencies to maintain a performance-neutral approach to the analysis, to the extent possible. Auto Innovators appreciates that the Agencies continue to consider high-speed acceleration, gradeability, towing, range, traction, and interior room (including headroom) in the analysis when sizing powertrains and evaluating pathways for road-load reductions. All of these parameters should be considered separately, not just in combination. (For example, we do not support an approach where various acceleration times are added together to create a single "performance" statistic. Manufacturers must provide all types of performance, not just one or two to the detriment of others.)

Tire Rolling Resistance Improvements

Auto Innovators discourages the addition of 30% tire rolling resistance reductions ("ROLL30") to the analysis at this time. Performance neutrality for cold weather traction, hot weather performance, wet weather traction, load handing (for additional weight of batteries, for instance), wear and durability, and noise, vibration, and harshness can be challenging to achieve for 20% tire rolling resistance reduction, and the technology pathway to ROLL30 for many vehicles remains unclear.

Aerodynamic Improvements

A 20% aerodynamic improvement relative to 2015 baseline vehicles remains challenging to achieve for many body styles, given form drags, and other regulations, like side view mirror requirements. Auto Innovators does not recommend considering additional aerodynamic improvements (such as 25 percent aerodynamic improvements, etc.). Some additional reductions in aerodynamic forces may be possible if side view mirrors were no longer required by NHTSA and FMVSSs.

EPA HCR2 Engine

In the GHG NPRM, EPA resurrected highly optimistic effectiveness estimates for future Atkinson cycle engines based on a speculative engine map, and used the results as "HCR2" technology. The use of this technology package can diminish the integrity of the analysis and distort discussions of technological feasibility and economic practicability of future standards. We recommend against the inclusion of this technology package in the CAFE Model at this time.

While some organizations have asserted that EPA's 2016 characterization of HCR2 is a reasonable characterization of engines in the market today, like Toyota's 2.5L on the Camry and RAV4,[327] or Mazda's 2.5L on the CX-5,[328] history has shown that the HCR2 assumptions used in EPA's analysis significantly and unreasonably overestimate the real-world fuel saving capability of state-of-the-art Atkinson engine technology in these applications. The EPA HCR2 engine map assumes engine accessory drive improvements ("IACC") and engine friction reduction ("EFR") have already been used to the maximum extent possible, so reapplying these technologies again in the modeling (as the EPA analysis does) incorrectly double counts the potential effectiveness of these technologies. EPA incorrectly states that HCR2 technology, as modeled, exists in the fleet and is widely available for adoption. Tables VIII-10, VIII-11, and VIII-12 below compare existing vehicles with advanced high-compression ratio engines to the modeled results for such vehicles, demonstrating the optimistic and speculative nature of the HCR2 technology modeling.

Table VIII-10: Comparison of EPA Modeled Toyota Camry Technologies and Fuel Economy to Actual Toyota Camry Technologies and Fuel Economy

Observation Year	Vehicle (Code)	Technologies	Fuel Economy (MPG)
2017 (EPA Baseline, compliance data)	Toyota Camry Se/SXe/Xle (2303000)	VVT; VVL; AT6; EPS; ROLL0; AERO5; MR0	36.8
2020 (DOT Baseline, compliance data)	Toyota Camry SE (2303010)	HCR1; AT8; IACC; ROLL0; AERO5; MR2; LDB	43.4
2024 (EPA NPRM, FE Projection)	Toyota Camry Se/SXe/Xle (2303000)	EFR; HCR2; AT8; IACC; ROLL20; AERO5; MR1	51.7

327 Characterized as HCR1 + IACC in the NHTSA baseline analysis.

328 Characterized as HCR1D in the NHTSA baseline analysis.

Table VIII-11: Comparison of Modeled Toyota RAV4 Technologies and Fuel Economy to Actual Toyota RAV4 Technologies and Fuel Economy

Observation Year	Vehicle (Code)	Technologies	Fuel Economy (MPG)
2017 (EPA Baseline, compliance data)	Toyota RAV4 Le/Xle FWD (2317004)	VVT; VVL; AT6; EPS; ROLL0; AERO0; MR0	34.9
2020 (DOT Baseline, compliance data)	Toyota RAV4 XLE (2317004)	HCR1; AT8; IACC; ROLL20; AERO10; MR2; 12VSS; LDB	43.4
2024 (EPA NPRM, FE Projection)	Toyota RAV4 Le/Xle FWD (2317004)	EFR; HCR2; AT8; IACC; ROLL20; AERO15; MR1	48.0

Table VIII-12: Comparison of Modeled Mazda CX-5 Technologies and Fuel Economy to Actual Mazda CX-5 Technologies and Fuel Economy

Observation Year	Vehicle (Code)	Technologies	Fuel Economy (MPG)
2017 (EPA Baseline, compliance data)	Mazda CX-5 Sport 2wd (2404001)	HCR0; AT6; EPS; ROLL0; AERO5; MR1	36.6
2020 (DOT Baseline, compliance data)	Mazda CX-5 Sport FWD (2404001)	HCR1D; AT6; EPS; ROLL0; AERO5; MR0; LDB	37.1
2023 (EPA NPRM, FE Projection)	Mazda CX-5 Sport 2wd (2404001)	HCR2; AT8; IACC; ROLL20; AERO15; MR1	45.3

<u>Scenarios Input File</u>

The following is a brief list of concerns with inputs in the CAFE Model Scenarios input file. We believe the impact of these issues on the overall results is minor, but recommend that NHTSA review these areas of the model and make changes as needed.

California Framework Agreement

- The California Framework Agreements are applicable to MY 2021, but are not modeled.
- The "G" and "H" target coefficients associated with the California Framework Agreements in the Scenarios central analysis standard-setting input file are incorrect for both passenger cars and light trucks. Many are close, within 0.5 g/mile, but others, particularly "H" coefficients for light trucks are up to 2.0 g/mile different.
- In general, all California Framework Agreement coefficients are over-specified (have too many decimal places).

Final (not Proposed for Revision) CAFE Standards

- MYs 2021-2023 minimum domestic passenger car standards are set to 92% (allowing the model to recalculate them) instead of the values from 49 C.F.R. § 531.5(d).

- MYs 2021-2023 CAFE target coefficients are over-specified (too many decimal places) relative to the final regulation.

Comments on CAFE Model Operation

Standard-Setting Mode for Certain Model Years

The CAFE model may be run in a mode that restricts the application of alternative fuel technologies in years determined by modelers for standard-setting analysis. This function is important given the 49 U.S.C. 32902(h)(1) and (2) prohibitions against consideration of alternative fuels in setting maximum feasible standards.

Previously, a modeler could exclude alternative fuel technologies from consideration with a setting in the Technologies file that allowed the technologies to either be excluded for all years ("Applicable" set to "FALSE" for the technology) or for years prior to a stated year (as designated under "Year Avail." for the technology). Typically, in standard-setting runs the "Year Avail." for alternative fuel technologies was set to sometime after (or well after) the proposed rulemaking timeframe, presumably to avoid multi-year planning optimization algorithms from inadvertently pulling alternative fuel vehicle technologies into the standard-setting compliance pathways during, or ahead of standard-setting years.

Today's analysis moves the mechanism to apply CAFE standard-settings restrictions to the Scenarios file. On each scenario tab, there are rows labeled "Standard Setting Year" that correspond to the regulatory classes, and modelers may set "Standard Setting Year" to "TRUE" for years that the CAFE model may not apply alternative fuel technology.[329]

Unlike previous input settings, today's mechanism enables the modeler to allow alternative fuel technologies to be applied before the years directly covered by the CAFE rulemaking, to restrict the additional application of the alternative fuel technologies during the years with standards directly affected by the CAFE rulemaking, and then to again allow alternative fuel technologies to be applied immediately after the years with new standards. The Central Case analysis presented in today's NPRM uses a new "on-off-on" approach, flagging years 2024, 2025, and 2026 and only these years as "TRUE" as standard-setting years.

When combined with multi-year planning, and civil penalty payment assumptions, the current approach for standard-setting years lead to unprecedented projected adoption of BEVs in 2023 as part of the projected compliance pathway to improve fleet fuel economy for the 2024-2026 CAFE standards. Notably, the penetration rates of BEVs differ between scenarios, making clear that much of the rapid adoption of alternative fuel technology is applied, based on multi-year planning, in preparation for rapid increases in CAFE standards stringency.

[329] Despite this setting, the model may still apply PHEVs, and the compliance fuel economy of PHEVs includes the benefits of operation on alternative fuel in violation of 49 U.S.C. §32902(h)(2), as described elsewhere in these comments.

Therefore, the current combination of assumptions presented in standard-setting runs still includes alternative fuel vehicles used to comply with the standards.

If the modelers desire to avoid the application of alternative fuel technologies in response to CAFE regulations (as required by the CAFE statutes) in standard-setting runs, this may be achieved by setting the Standard Setting Years as "TRUE" for all years leading up to and including the proposed regulation years. Additionally, years after the rulemaking years may be set to "TRUE" if civil penalty payment is allowed up to, and past the rulemaking period. To ensure compliance benefits of alternative fuel vehicle technology applied after the rulemaking period do not carry back into the years directly covered by the standards, modelers may consider applying "TRUE" to all years up to and including the rulemaking period, and years following the rulemaking period equivalent to the fleet average time between redesigns[330] minus the fleet average age of engineering design.[331] Following this guidance, modelers could set the Standard Setting Years as "TRUE" from 2020 – 2030 for today's 2024-2026 standard-setting analysis.

If the practice of applying "TRUE" to Standard Setting Years for only years for which the new regulations directly affect continues, that could lead to some truly bizarre (and not encouraged) modeling practices. For instance, if new standards are set for only one year, and that year is a few years in the future, and alternative fuel vehicles are allowed to be applied both before, and after that year, most of the compliance pathway could be projected as using alternative fuel vehicles in years surrounding the one rule-making year. After all, only a small portion of the fleet is redesigned in any given year,[332] so it is expected that efficient compliance pathways in response to regulation in any given year will spill over into surrounding years.

The Standard Setting Years input settings should take multi-year compliance pathways into account and lead to thoughtful projected compliance pathways, especially with respect to alternative fuel vehicles.

<u>Capability to Simulate Other Standards</u>

The version of the CAFE Model used in the current CAFE NPRM is incapable of fully simulating proposed EPA GHG standards. It is also incapable of fully simulating the California Framework Agreements despite NHTSA's claims of having done so.

Both the proposed EPA standards and the requirements of the California Framework Agreements provide a capped incentive multiplier for BEVs and PHEVs. These caps are administered on a cumulative, manufacturer-specific basis over a period of years in both the proposed EPA regulations and California Framework Agreements. The current version of the

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[330] *E.g.*, 6.5 years, as shown in Table 2-3 of the *CAFE TSD* (*supra* note 18).

[331] *E.g.*, 2.8 years, as shown in Table 2-4 of the *CAFE TSD* (*supra* note 18).

[332] Table 2-2 in the *CAFE TSD* (*supra* note 18) states that 15.9% of the fleet (by unit sales) was new in 2020.

CAFE Model does not provide input fields for separate EPA and California Framework Agreement EV Multipliers, nor does it have programmed capability to account for the cumulative cap structure. We recommend that NHTSA (and EPA, presuming a consistent modeling tool) add this modeling capability before the next rulemaking, if not for the final rule associated with the present GHG and CAFE proposals.

Interagency Coordination

In general, we believe that the Agencies should use a common set of input assumptions and modeling tools. Common input assumptions and modeling tools would improve government efficiency and speed up evaluation by stakeholders during the rulemakings and comment periods. Such inputs and tools should be an interagency effort, drawing from the expertise of DOT, EPA, DOE, and national laboratories, and in coordination with CARB. The modeling tools should have the capability to simulate compliance simultaneously and separately with EPA, NHTSA, and state regulations related to fuel economy. They should also have the capability to model significant final legal agreements such as the California Framework Agreements to the extent possible. Manufacturers must simultaneously comply with each regulation related to fuel economy, and therefore compliance modeling tools should do the same. We recognize that the Agencies will likely need to operate such models individually for consistency with their statutory authority. For example, EPA may model electric vehicles as part of its standard-setting evaluation, whereas NHTSA may not.

Regulatory analysis is generally conducted as a comparison between action and no-action scenarios. We believe this remains appropriate. However, the Agencies should also coordinate and report the net costs of all combined regulations and agreements related to fuel economy and GHG emissions relative to a baseline year (*e.g.*, MY 2020 in the case of the CAFE NPRM). Doing otherwise could mislead policymakers into believing the costs of a particular regulation are relatively low because the actions would otherwise occur. This is particularly true when EPA and NHTSA are proposing related GHG and CAFE standards for the same year(s). It would be nonsensical that both Agencies claim costs and benefits associated with separate regulations that have large overlapping effects. Similarly, consideration of the consumer-facing costs of the ZEV Mandate are of particular importance in the assessment of EPA GHG and NHTSA CAFE regulations. While the EPA and NHTSA regulations may be technology-agnostic (insofar as any particular technology is capable of improving vehicles as required), the ZEV Mandate defines a required technology pathway no matter how technology-neutral the GHG and CAFE regulations are. As noted elsewhere in these comments, NHTSA must be careful in how and where it considers the ZEV Mandate. The costs are important, but NHTSA may not consider alternative fuels in determining the maximum feasible level of standard.

Appendix IX: Technical Issues with Draft Regulatory Text

Auto Innovators recommends correction of the following technical issues in the draft regulatory text. The suggested edits are made presuming finalization of the CAFE rule as proposed, notwithstanding any opposing or modifying comments provided herein by Auto Innovators.

1. 49 C.F.R. § 531.5(c), Table 3: The "a" coefficient for the MY 2026 passenger car fuel economy target is inconsistent with that described in the preamble.[333] The regulatory text should be corrected to match NHTSA's final decision on passenger car fuel economy targets.

2. 49 C.F.R. § 531.6(b)(3)(i)(A): NHTSA specifies a required deadline "*if* prior to the applicable model year." (*Emphasis* added.) Presumably the text is intended to read simply "prior to the applicable model year."

3. 49 C.F.R. § 536.4(c), Table 1: The table of lifetime vehicle miles traveled (VMT) inputs for the traded / transferred credit adjustment factor provides values for MYs 2012-2025. A value for MY 2026 is required. Auto Innovators suggests that the values for MYs 2017-2025 be extended to MY 2026.

4. 49 C.F.R. § 535.5(a), Figure 4: The equation shown is missing a comma between the "h" and "1/e" terms.

[333] CAFE NPRM (*supra* note 2) at 49753.

Attachment 1: Description of Analysis for Assessment of CAFE to GHG Harmonization

The following steps were performed in the analysis.[334]

1. Vehicles Report Output File Preparation.

    a. Remove unnecessary data, leaving only results for Alternative 2, MYs 2022-2026. (MYs 2022-2023 are not subject to the proposed CAFE revisions, but affect the electric vehicle multiplier credit impact of the EPA GHG rules as a result of the cumulative cap on such credits.

    b. Add a column for the proposed EPA EV Multiplier with values based on the Powertrain and Model Year fields in the Vehicles Report, and the GHG NPRM.

    c. Add a column that calculates the CO_2-equivalent of the FE Compliance field.

    d. Add a column to convert the Reg Class field for imported and domestic passenger cars into a single fleet of passenger cars.

    e. Add a column defining lifetime mileage for each vehicle based on its regulatory class. The lifetime mileage assigned was based on that found in 40 C.F.R. § 86.1865-12.

    f. Add a column to recalculate the CO_2 target for each vehicle based on the Footprint field and the proposed EPA standards (GHG NPRM). (This is necessary because the original analysis assumed a mix of California Framework targets and targets from the 2020 SAFE Rule.)

    g. Calculate adjusted production based on the Sales field and the added EV Multiplier field. (This is necessary for calculating the EV Multiplier benefit.)

    h. Add a column to calculate base CO_2 credits for each vehicle. (This is necessary for calculating the EV Multiplier benefit.)

    i. Add miscellaneous calculation columns to support pivot table calculation of production-weighted fleet average values.

2. Calculation of production-weighted fleet average compliance. Create a pivot table to calculate production-weighted fleet average CO_2-equivalent fuel

[334] Calculation spreadsheet available by request.

economy compliance and production-weighted fleet average CO_2 compliance for each model year and compliance fleet.

3. Calculation of variables used in the EV Multiplier credit calculation. Create a pivot table to calculate values needed for the calculation of EV Multiplier credits including production-weighted fleet average CO_2 target, production-weighted fleet average CO_2-equivalent fuel economy, production-weighted fleet average CO_2, EV Multiplier adjusted production, production-weighted fleet average EV Multiplier adjusted CO_2 standard, and production-weighted fleet average EV Multiplier adjusted CO_2 emissions for each model year, compliance fleet, and manufacturer.

4. Calculation of harmonization.

    a. Comparison of fuel economy to CO_2 targets. Obtain the NHTSA-projected CAFE standard from the Compliance Report output file. Convert to CO_2-equivalent assuming 8,887 grams CO_2 per gallon of fuel. Compare this to the recalculated CO_2 targets from Steps 1.f. and 3. This is the numerical difference between the targets before considering the differences which impact stringency.

    b. Quantify the impact of the direct A/C emissions credits. Obtain the NHTSA-assumed EPA direct A/C emissions credits from the Market input file and calculate a production-weighted fleet average for each year and fleet.

    c. Calculate the impact of zero grams per mile tailpipe emissions for electricity (EPA) vs. petroleum equivalency factor for CAFE as the difference between the production-weighted fleet average CO_2-equivalent fuel economy and the production-weighted fleet average CO_2 emissions from Step 2.

    d. Calculation of EV Multiplier credit impact. Using the values from Step 3, calculate EV Multiplier credits based on 40 C.F.R. § 86.1866-12 with proposed modifications from the GHG NPRM, including accounting for the cumulative cap on a per-manufacturer basis. Convert these values to fleet averages.